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PERENNIAL RYE-GRASS STRAIN INVESTIGATION.

DATA FROM TRIALS AT THE PLANT RESEARCH STATION.

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IN this *Journal* for July, 1929, it was pointed out by the writers that marked variation existed in commercial lines of perennial rye-grass. In the account of the early trials the fact of the annual Italian rye-grass element in the lines of different origin was clearly set out, and some idea was given that marked differences existed in the behaviour of the perennial rye-grasses of various origin, apart altogether from the Italian rye-grass present in the line (Table 1, page 4, July, 1929). The present article deals in greater detail with the trials conducted at the Plant Research Station, Palmerston North, and aims to set out the technique employed and the results gleaned to date.

In our preliminary report we stated that Hawke's Bay and Poverty Bay rye-grass as commercially handled in New Zealand was as a type quite different and apparently quite superior to rye-grass harvested in other parts of the Dominion. While the tabulated results as set out here are based largely on data secured from one- and two-year-old plots, yet much confirmatory field evidence has been secured from areas sown by the Fields Division extending over a considerable period. Further than this, circumstantial evidence of farmers who have used Hawke's Bay rye-grass for many years and evidence collected by the writers on the Hawke's Bay and Poverty Bay flats would lead us to the definite conclusion that, provided the conditions are good enough to grow rye-grass, the Hawke's Bay strain will maintain itself as a dominant in the sward for any number of years. So marked, in fact, is the superiority of this strain over other strains that the Department of Agriculture this season initiated an extensive scheme of rye-grass seed certification, which really represents the first practical step towards a righting of the rye-grass strain position in New Zealand. †

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† See article, "Certification of Grass and Clover Seeds," by J. W. Hadfield, in this *Journal* for November, 1929.

Details of Trials and Technique employed.

The trials include (1) broadcast plots, (2) turfs or seed of rye-grass from various habitats planted or sown in rows, and (3) single spaced plants.

(1) broadcast plots.

Where sufficient seed is available broadcast seedings are made, and the standard plot adopted is $\frac{1}{500}$ acre in area, the measurement being 30 links by $6\frac{2}{3}$ links. The amount of seed sown is 40 lb. per acre. These plots are sown in duplicate, and are subdivided transversely into three parts to allow a triple system of utilization to be carried out. One part is mown consistently once every week with a lawn-mower; the second part is mown with a motor hay-mower when the grass is in the 6 in. to 8 in. "cattle" stage; and the third portion is similarly cut at the hay stage when the grass is in flower. No reseeding is permitted to take place. The plots are uniformly manured with superphosphate and sulphate of ammonia, and a high standard of soil-fertility is maintained throughout the period of the trials.

Detailed observations have been made from time to time on the behaviour of each line under this triple system of utilization, and a system of relative marking by eye estimation is employed. A scale of marking, 0–10, has been adopted in respect of differences between plot and plot. Establishment, relative growth, persistency, recovery after cutting, type as shown by morphological and colour differences, swarding characteristics, and disease resistance or susceptibility are measured in this way. Eye estimations in regard to persistency and swarding characteristics under weekly cutting are wherever possible supported by accurate statistical analyses of the sward *in situ*, using the point-quadrat method.

No stock-grazing has been done on the trial plots under consideration, but the same lines or representatives of the same types have been sown out in the field on all the leading soil-types in New Zealand, and the behaviour of each line or type in the field is closely correlated with that in the mown series at the Plant Research Station. All told, 3,590 plots of rye-grass, representing some 300 different lines, have been sown out and are under grazing trial in the field. These field trials are yielding important data which it is hoped will form the subject of a subsequent paper by the writers.

In the trials at Palmerston North no effort has been made to secure cut weights of herbage produced by each line or type. We are of the opinion, so far as species and strain trials are concerned, that mere weights as such, without further and complete botanical analyses, are not worth while. The need for botanical analyses of cut herbage, if weights are used as a measure of increase or decrease, can be readily seen from a glance at Table 7. The enormous increase in white clover would largely counteract loss of rye-grass as far as the weight measure was concerned, and this could be shown only by dissecting out and separately weighing the components of the cut herbage of each plot, or by some comparable system of accurate estimation of the botanical content of that herbage. From our experiences with a limited working staff it is more practicable in preliminary trials where wide differences occur to concentrate on the testing out of a large number of lines; and

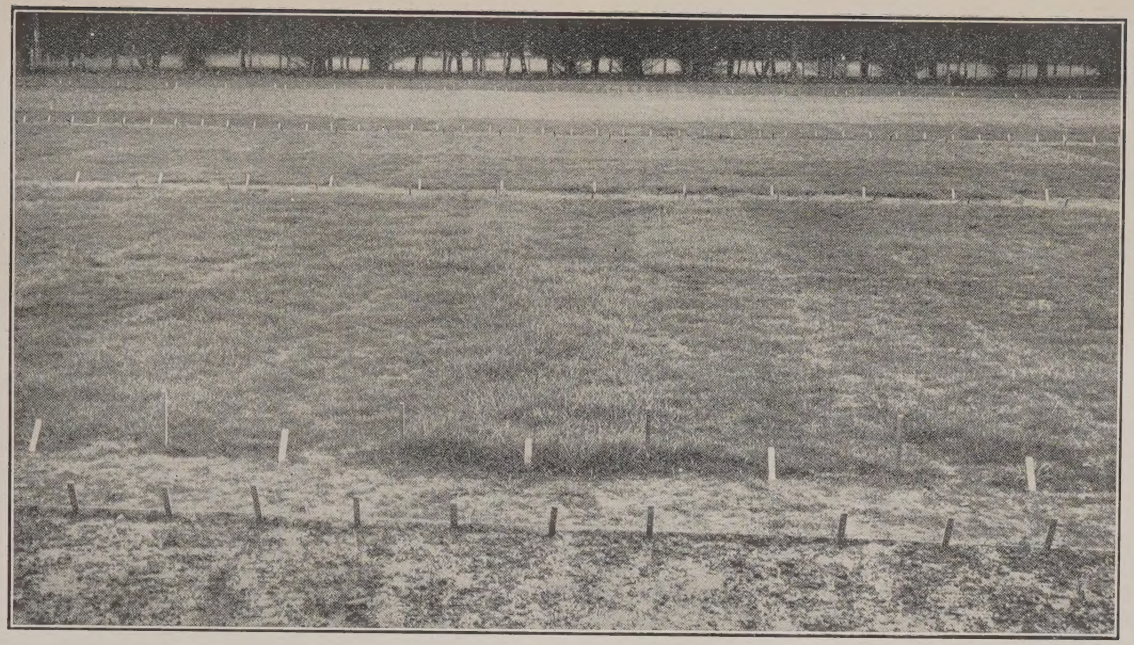

FIG. I. VIEW OF PORTION OF TRIAL GROUNDS AT PALMERSTON NORTH.

This photo shows differences at an early stage in the broadcast plots of commercial "perennial" rye-grass lines under test. These differences have been closely studied in the broadcast under differential mowing and in single plants drawn at random from the plots.

[*Photo by E. Bruce Levy.*

to analyse these by eye estimation carried out at regular intervals, supported by accurate notes taken in the field, together with sward analyses *in situ* of representatives of the major types that assert themselves.

Up to date between 1,700 and 1,800 lines of perennial rye-grass seed have been received at the Plant Research Station for testing in the ground trials, and of these some 1,500 lines have been sown in broadcast plots in duplicate and subjected to the aforementioned triple-mowing scheme under constant observation and note-taking.

(2) TURFS OR SEED FROM VARIOUS HABITATS PLANTED OR SOWN IN ROWS.

Where turfs are collected in the field or where insufficient seed is available to sow the standard broadcast plot the row system of testing is adopted. The rows are either 15 links or 30 links long and are 2 ft. apart. When the seed is well up or the transplanted tillers well established the bed to half its width is sown broadcast with a more or less lawn-seed mixture not containing any seed of the species under trial in the rows, and this half portion is treated as a broadcast plot and cut weekly with a lawn-mower. Thus half the row is tested as under broadcast conditions and the other half is kept intercultivated. It is our opinion that the intercultivated-row system alone is not an adequate test for pasture plants, particularly those that definitely have their crown above ground. Rye-grass, cocksfoot, red clover, and timothy come within this category. Some 250 lines of rye-grass have been planted or sown in the above trials.

(3) SINGLE SPACED PLANTS.

In the broadcast plots eye differences as to type manifested themselves after some eight weeks from sowing. In order to study the individual plants that in the aggregate gave rise to that eye difference single plants were taken at random, 100 from each broadcast plot. These were put out 2 ft. apart each way and studied as single plants from the point of view of growth-form, recovery after cutting, persistency, colour-variation, disease resistance or susceptibility, &c. This single-plant trial is yielding also a certain proportion of promising types, which are now being used as a basis for selection and for the working up ultimately of elite strains. The single-plant study is also showing up to a marked degree the entire lack of uniformity of type even in what we consider the best of the Hawke's Bay lines, indicating that enormous possibilities for improvement await the skilled hand of the plant-breeder and strain-ecologist.

In regard to the general procedure in the economic breeding of pasture plants and in the building-up of improved strains from selected material, and having due regard to the fact that these studies are merely in their infancy, we hold the view that the first step is to test out large numbers of types drawn from every corner of the globe, both as broadcast plots and as single spaced plants that are in all cases submitted to a number of contrasting schemes of management; to study growth-form in relation to yielding-power and persistency; to study type, tillering-capacity, seasonal growth, disease-resistance, and the like, both of the aggregate strain and of the dissimilar individuals that

make up that aggregate. Following on this preliminary survey, the more likely growth-forms can by mere selection and culling be grouped together to produce improved aggregate types that are likely to be vastly superior to the existing commercial types. Concurrently with this analysis and selection should go the genetical analysis of the several more likely growth-forms with a view to producing economically superior and more useful lines that are, within reason at any rate, genetically pure and are likely to remain so indefinitely under a carefully controlled scheme of seed-production.

During August, 1929, some 5,500 single plants of rye-grass, representing fifty-three distinct lines of seed, were planted as spaced plants, and a special report on the behaviour of these will be made at a later date.

Progress Results of Broadcast Plots.

After two years' concentrated work at the Plant Research Station, and as a result of several years' widely distributed trials and observations throughout the country, there is in the minds of the writers no shadow of doubt that the Hawke's Bay rye-grass as a type is superior, for New Zealand conditions at least, to any other commercial strain from any other source. Prior to this work species, or mixtures of these, were accepted in New Zealand as the only thing one had to consider in the laying-down of pastures. This work emphasizes that strain counts more than species, and that source of origin is a factor to be reckoned with in the buying of grass and clover seeds.

The Department is fully alive to the situation created by this work, and in order to give some means of guarantee as to type and district of origin it inaugurated and carried out, under the direction of Mr. J. W. Hadfield, Agronomist, the scheme of rye-grass seed certification already referred to. We recognize in this scheme the germ of an organization that may surpass in economic importance the stud-book of the stock-breeder and the milk test for the dairy cow. The support that seed-merchants and farmers are giving to this movement must ultimately be reflected in pedigree-seed production not only for New Zealand's own requirement, but substantially the basis of a large seed-export trade.

Classification of Commercial Rye-grass according to Type.

In our trials we have been able to recognize six types within the commercial rye-grass of New Zealand, and as this classification is referred to throughout the present article descriptive notes of each type are given hereunder.

Type 1.—Hawke's Bay, Poverty Bay, and a few of the best Sandon lines have in general been placed in this group. Characteristically deep green in colour, making dense leafy growth at all seasons, and showing rapid recovery after cutting.

Type 2.—The bulk of Sandon rye-grass has gone into this group. Rather lighter in colour than Type 1, especially marked in the early growth stages; and this colour difference has later proved to be directly associated with a relative lessened persistency.

Type 3.—This group comprises the best of the South Island lines, which, while showing a fairly good colour, were as a whole more greyish-green in the early growth-periods, of divaricating habit in the broadcast plots, and having the individual plants open at the crown with more or less prostrate shoots. This type has persisted as well as Type 2 up to date, but not nearly so well as the best "true perennial" lines of Type 1.

Type 4.—The light-greyish-green colour, divaricating habit, and loose open crown associated with "false perennial" is typical of this group, which includes most of the Southland, Otago, and Canterbury lines, and may be regarded as the average "false perennial" coming from South Island districts. There is a very decided falling-off in persistency as compared with Type 3.

Type 5.—This type shows characteristic colour-differences very soon after soil establishment. Germination is as rapid as in Italian rye-grass, but looked on as a plot it typically assumes a steely grey-green colour quite distinct from the yellow green of Italian rye-grass or of the deeper green of true perennial rye-grass. The plants are spreading in habit of growth, and while making rapid seedling growth are unable to recover after being cut back. In many respects this type shows close affinities with Italian rye-grass, and in some ways is suggestive of a derivative of crossing between the normal "false perennial" of Type 4 and ordinary Italian. Single-plant studies have emphasized the approach to Italian rye-grass characteristics in this form, but it is important to note that in no case has the type shown the vigour associated with Italian rye-grass in the first year.

Type 6.—Normal Italian rye-grass sold as "perennial" or merely as "rye-grass." Single-plant studies have shown that there was a trace of perennial rye-grass in some of the lines placed in this group. The plots were all rapid in growth from seed, typically erect, and light yellowish-green in colour. Recovering well from the earlier cuts, Italian rye-grass failed to last the season, going out first and most completely on the weekly-mown section.

Distribution of the Types in New Zealand.

In Table 1 is set out the distribution in New Zealand of the commercial perennial rye-grass types according to source of origin as supplied with the seed. The figures indicate that most of the samples definitely stated to be of Hawke's Bay and Poverty Bay origin approach the "true perennial" type, whereas lines from Southland and Canterbury, including South Canterbury, are definitely of the "false perennial" type. Sandon rye-grass on the whole inclines towards the "true perennial"—in fact, a few of the best Sandon lines under test were indistinguishable from the average Hawke's Bay lines. Sandon rye-grass, however, taken as a whole, contains an excessive proportion of Italian rye-grass, some of the lines being dominant Italian with very little perennial. South Canterbury rye-grass is perhaps more predominantly Italian rye-grass than that from other sources of origin in New Zealand. Occasional samples were received, however, from Southland, Canterbury, Otago, Marlborough, and the Wairarapa, which proved to be dominant Italian.

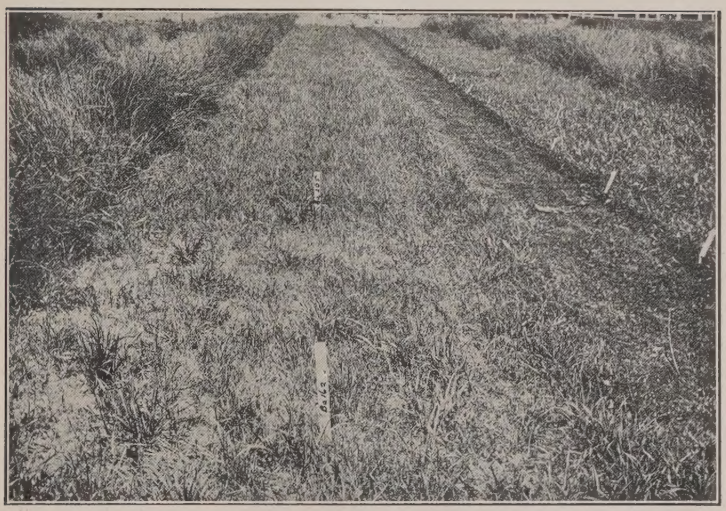

FIG. 2. RECOVERY OF FALSE PERENNIAL COMPARED WITH TRUE PERENNIAL.

In the foreground on left of path are two plots of false perennial (Southland Type 5), and behind the second label are six plots of true perennial (Hawke's Bay Type 1). The photo shows recovery after first hay-cut. The tall growth is the "cattle series" allowed to run up to flower.

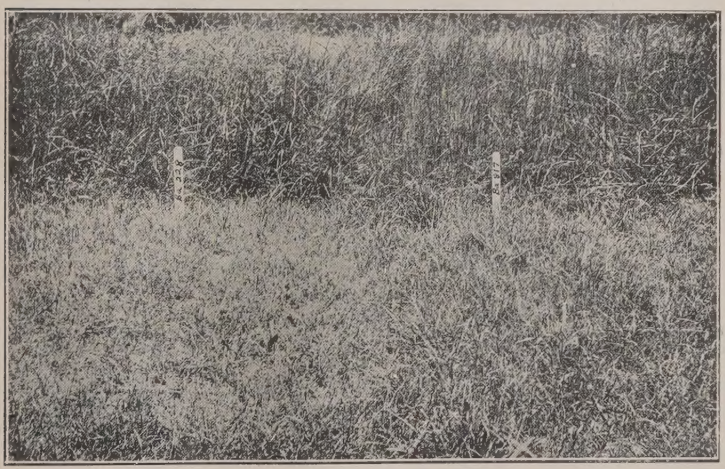

FIG. 3. SHOWING RECOVERY, IN FOREGROUND, AFTER HAY-CUT.

True perennial (Hawke's Bay Type 1) on right; false perennial (Canterbury Type 5) on left. Cattle series behind labels.

[*Photos by E. Bruce Levy.*

Table 1.—Strain Analysis of 841 Lines of Commercial "Perennial" Rye-grass of stated District of Origin.

District of Origin.	True Perennial, Types 1 and 2*—Number of Lines.	Best Type of False Perennial, Type 3—Number of Lines.	False Perennial, Types 4 and 5—Number of Lines.	Dominant Italian, Type 6—Number of Lines.	Total Number of Lines under Trial.	Percentage of True Perennial.
Hawke's Bay	175	1	8	5	189	93
Poverty Bay	32	..	2	1	35	92
Sandon	46†	3	8	7	64	72
Mid and North Canterbury	7	16	56	17	96	7
South Canterbury ..	3	9	38	34	84	4
Southland	3	27	269	9	308	1
Maniototo	2	4	16	2	24	8
Wairarapa	5	1	3	3	12	42
Marlborough	2	7	1	1	11	18
Imported	1	9	7	1	18	6

* But may contain a trace or some Italian rye-grass. † Many lines contain a fair percentage of Italian.

Rye-grass Types handled at Main Distributing Centres.

In Table 2 is set out the position as regards the type of rye-grass handled at the main distributing centres in New Zealand. Auckland handles rye-grass from all over New Zealand, but draws a not inconsiderable proportion from the Hawke's Bay and Gisborne districts. It would appear as if rather less than half the Auckland supplies are of the "true perennial" type.

The East Coast towns, Hastings, Napier, and Gisborne, deal in the main with locally-grown seed, as shown by the preponderance of the "true perennial" types that are handled. A small proportion of seed from the South Island, however, is brought in by these towns, especially in years when the local harvest is below normal. The inadvisability of this procedure is self-evident, and is emphasized by the poor results that have been obtained from sowings of Southern

Table 2.— Strain Analysis of 830 Lines of New Zealand Commercial "Perennial" Rye-grass as sold in the several Main Distributing Centres of the Dominion.

Distributing Centre.	True Perennial, Types 1 and 2—Number of Lines.	Best Type of False Perennial, Type 3—Number of Lines.	False Perennial, Types 4 and 5—Number of Lines.	Dominant Italian, Type 6—Number of Lines.	Total Number of Lines under Trial.	Percentage of True Perennial.
Auckland	25	3	23	3	54	46
Hawke's Bay and Poverty Bay	120	..	1	4	125	96
Palmerston North and Feilding	89	14	25	9	137	65
Christchurch and Ashburton	7	18	48	14	87	8
Timaru and South Canterbury	3	8	37	34	82	4
Dunedin	2	1	42	2	47	4
Gore and Invercargill ..	2	29	259	8	298	1

seed made from time to time in the East Coast districts. Palmerston North and Feilding draw a good deal of their supplies from the adjacent Sandon district, a small proportion is bought in Hawke's Bay, and a good deal from the South Island. The number of samples under test from Wellington was small, and the figures for this centre therefore had little significance. It is apparent, however, from our tests that Wellington deals in large part with rye-grass seed from the South Island.

Christchurch and Ashburton draw their supplies of rye-grass seed from the surrounding districts. The towns of South Canterbury—Timaru, Geraldine, and Waimate—are also supplied by local growers. Dunedin, Gore, and Invercargill appear to deal wholly with Otago and Southland rye-grass. The whole supply of the South Island towns being drawn from local sources is preponderantly of the "false perennial" type; the data emphasize really that these towns are export centres sending considerable quantities of their rye-grass to the North Island and overseas. This export means failure of the rye-grass in any permanent pastures sown down in the North Island, and militates against New Zealand gaining pride of place in the seed trade overseas.

The only consolation—if that it be—we have in the meantime is that no overseas country is producing a true perennial rye-grass type suitable for pasture purposes. The imported lines we have had under test are, as a whole, no better than the false perennial from the South Island.

Imported and New Zealand Types compared.

All the English, Irish, and Scottish lines have failed badly during the second year of trial; pedigree lines of leading Scotch firms, special indigenous perennial lines, Pacey's Evergreen, &c., as sold by leading English firms, have likewise gone out. Lines from Germany, Sweden, and Poland range from bad to good false perennial type, while an American line sold under the name of "Oregon awned perennial rye-grass" proved to be nothing more than ordinary Italian.

In this connection the following analysis of data comparing New Zealand and overseas types is illuminating:—

Table 3.—Comparison of the Six New Zealand Rye-grass Types with imported "Commercial Perennial."

Origin.	Relative Recovery after Cutting—Plots Eleven Months old.	Relative Excellence of Turf produced after Twelve Months.	Relative Persistency at Twelve Months as shown by Point Analysis	Relative Degree of Rust-resistance.
New Zealand Type 1	100	100	100	100
New Zealand Type 2	87	91	86	
New Zealand Type 3	70	80	88	36
New Zealand Type 4	34	55	40	
New Zealand Type 5	15	25	32	
New Zealand Type 6	..	22	18	100
Imported	49	42	55	35

From these figures it will be seen that the average imported commercial type falls, as it were, in performance and behaviour between

Types 3 and 4. Persistency trials after eighteen months (see Table 6) would indicate that it was nearer Type 4 than Type 3. The high susceptibility of the imported lines to rust-attack emphasizes also the poor-growth and strain characteristic of these lines. Certainly, then, it would appear that New Zealand has nothing to gain by importing rye-grass for the purpose of improving the position as it exists to-day. Undoubtedly the problem that lies ahead of us is to make the best possible use of the available true perennial type we have in the Hawke's Bay and Poverty Bay districts; to sink any parochial differences we may feel, and to set to work in real earnest to propagate and improve this strain, not only for the country's own requirement but also to make fame for New Zealand rye-grass overseas, even as the Dominion is now famed for its butter, cheese, lamb, and apples, remembering also the value of another string to our bow in times of trade depression. The Department of Agriculture will be behind any such effort with the certification scheme now in operation.

Need for Certification Scheme in New Zealand.

The need for a proper scheme of certification is emphasized by the following statement, which is based on our trials in respect of lines stated to be of Hawke's Bay, Poverty Bay, and Sandon origin respectively.

Table 4.—Strain Analysis of Rye-grass Lines reputed to be of a certain District of Origin.

District of Origin.	True Perennial free of Italian—Number of Lines.	True Perennial containing a Trace or some Italian—Number of Lines.	False Perennial—Number of Lines.	Dominant Italian—Number of Lines.
	(1)	(2)	(3)	(4)
Hawke's Bay	135	40	9	5
Poverty Bay	25	7	2	1
Sandon	17	29	11	7

In the present certification scheme only those lines in column 1 would pass field inspection for mother seed. Those in column 2 would pass as fit for permanent pasture seed, while those in columns 3 and 4 would be rejected.

The point we wish to make here, however, is that none of our trials of rye-grass of guaranteed origin from Hawke's Bay and Poverty Bay have shown 100 per cent. false-perennial characters, and it would appear as though some 5 per cent. of the lines sold as Hawke's Bay are of South Island origin and some 17 per cent. of the Sandon lines are definitely South Island type. This also does not take into consideration the possibility of adulteration of Hawke's Bay, Poverty Bay, or Sandon with seed of Southern origin; and, while we do not wish to stress this point, many of the lines reputed to be of the former origin under strict weekly mowings have not stood this severe test as well as one would have liked. Price quotations, also, from overseas, particularly from Australia, would indicate that much false perennial of South Island origin was being sold in that country under the popular name of "Poverty Bay rye-grass."

FIG. 4. RECOVERY "HAY SERIES" IN FOREGROUND AND "CATTLE SERIES" IN BACKGROUND.

True perennial (Hawke's Bay Type 1) on left, and dominant Italian (Marlborough Type 6) on right. Note that after the second hay-cut the true perennial is beating the Italian type in recovery. In the background, it will be seen, recovery after first hay-cut is dominantly towards leaf in Type 1 and towards stem in Type 6. Types 4 and 5 behave in this respect similarly to Type 6.

FIG. 5. SWARDING PERSISTENCY UNDER WEEKLY CUT WITH LAWN-MOWER.

True perennial (Hawke's Bay Type 1) on left, and dominant Italian (Type 6) on right. Same plots as shown in Fig. 4.

[*Photos by E. Bruce Levy.*

An article by Professor R. G. Stapledon, of the Welsh Plant Breeding Station, Aberystwyth—"Herbage Seed Production in New Zealand: IV. Perennial Rye-grass and Dogstail," published in the *Journal of the Ministry of Agriculture* (London) for September, 1927—is of interest in this connection. A summary is given of experience with New Zealand rye-grass at Aberystwyth. The comparative behaviour of authentic lines of Hawke's Bay rye-grass now being tested at that station will be of the utmost importance to seed growers and merchants in New Zealand.

True Perennial and False (or Pseudo) Perennial compared.

The difference between the true perennial rye-grass and the false perennial becomes apparent very soon after soil establishment. The true perennial (Hawke's Bay and Poverty Bay type) is rather less rapid in seedling growth, and after about eight to ten weeks takes on a distinct deep-green colour, the individual plants tending to be upright and the numerous tillers closely packed. Normally false perennials (Southland and Canterbury strains) establish more rapidly, and soon take on a yellowish and then a greyish-green colour. The crown is fewer-tillered and open, the whole plant being divaricating rather than erect, and the tillers loosely packed at the crown.

The false perennials and the true perennials made approximately equal growth during the first winter following autumn sowing; both were outyielded as winter producers by Italian rye-grass. When the system of differential cutting was initiated in the early spring, however, the false perennials did not show the ability to recover from frequent cutting, whereas the true perennials consistently showed rapid recovery even under the most severe weekly clipping treatment. Italian rye-grass recovered well from the earlier spring cuttings, but failed to persist after mid-season. The false-perennial types, therefore, while having none of the advantages of rapid winter and early spring production characteristic of Italian rye-grass, have also none of the persistency attributes of true perennial rye-grass.

The colour differences noted in the broadcast plots of Hawke's Bay as compared with South Island seed have definitely proved on the past year's experience to be associated with differences in persistency, seasonal production, and time of flowering. The deep-green, erect-leaved, tufted, and multitillered Hawke's Bay type has maintained itself even under frequent cutting, while the lighter greyish-green colour and divaricating habit of the Southern rye-grasses has been associated with lack of tillering and the inability to persist either in the hay section, under infrequent cutting in the "cattle" section, or under the system of weekly cuts. At all seasons during the past year the trial grounds presented a checkerboard appearance, where the more persistent actively-growing true perennials were alternated with the non-persistent almost truly annual rye-grass of the South Island.

This is quite apart from a consideration of the Italian rye-grass element, which is all too often found as an admixture in our commercial perennial rye-grass. Many lines from Hawke's Bay and Poverty Bay contain a small proportion of straight-out Italian rye-grass usually derived from maiden seed paddocks, but from a purely practical standpoint the small amount of Italian in the sample is of little consequence

for permanent pasture sowing so long as the sample is predominantly of the proper pasture type. In illustration of this principle we may mention one line of Hawke's Bay rye-grass under test which proved to be more than half Italian, but the remainder of the sample was true Hawke's Bay type. That plot now at eighteen months old is far and away better than adjacent plots sown with false perennial rye-grass which originally contained no trace of Italian. For pasture purposes, therefore, it is better to sow a good perennial rye-grass type even if the sample is found to contain a trace of Italian, than to sow the false-perennial annual forms no part of which will last into the second year of grazing.

In the leaf-shoots, seed-heads, and general seed crop the types of rye-grass show some characteristic differences. In the seedling stages the true perennial is invariably folded in the leaf-bud and the tiller is flat-stemmed. At a similar growth-stage the false perennial usually tends to roll or at least to be less perfectly folded in the bud, and the tiller just below junction of blade and sheath is more or less circular in cross-section. In the period just prior to panicle-production both the true and the false perennial incline towards a rolling of the leaf in the advanced tillers. The true-perennial seed-stalk stands stiffly erect with but slight tendency to droop in the seed-head itself. The false-perennial seed-stalk is not so erect, but divergent, with a decided droop or arch of the seed-head. This characteristic is perhaps not so marked in heavy seed-crops, but is extremely marked in crops which have been grazed until fairly late in the season—that is, in the lighter seed-crops where the heads are not drawn up but are permitted to assume their natural divergent and drooping habit. The true Italian rye-grass is always rolled in the leaf-bud, and the tiller stem is always circular in cross-section. The seed stem is erect and taller than those of the foregoing perennial types, and the admixture of the latter in either is readily discernible by this tallness, together with a marked drooping of the head and well-marked awn of the seed.

The true perennial is never awned; the false perennials are never strongly awned, but in a percentage of cases short awns or awn-points appear, especially near the apex of the panicle and in the apical and subapical florets of some of the lower spikelets. Many lines of false perennial show scarcely any awn, but the seed itself is usually bigger than the true perennial and the individual spikelets of the seed-head are broader and not so compact. There is no doubt in our minds that the absence of awn on these false perennials has been largely responsible for acceptance of this type by seed-buyers, who relied in the past so implicitly on the belief that unless a line was awned it must necessarily be perennial rye-grass. In our field inspection work during the past year in connection with rye-grass certification we definitely rejected any paddock that contained even a trace of heads carrying these short awns. The general divergent nature of the seed-stems and arched droop of the head in every case confirmed the short-awn diagnostic feature and identified the line as a false perennial rye-grass. We should like, however, to record our firm belief—even against knowledge in specific instances of hard dressing to remove awns—that most seed-merchants have bought and

sold these awnless false-perennial lines in the best of faith and belief that they were handling and offering true perennial rye-grass seed.

The general behaviour, growth-form, and structure of the false perennial would indicate intercrossing of perennial and Italian rye-grass, and from our general experiences we are of the opinion that the short-lived rye-grass characteristic of Southern seed has been derived firstly by unconscious selection of short-lived strains of perennial rye-grass consequent upon seed-production for long-continued periods under arable and short lea conditions, and secondly by the admixture in seedlings of this short-lived perennial rye-grass with Italian, with resultant intercrossing.*

It seems, therefore, that the false perennials are derivatives first by strain selection towards short-lived perennials, followed by an intercrossing of this type with Italian rye-grass.

Data in Relation to Recovery after cutting.

The ability to recover after cutting is an important feature of a good strain of rye-grass. It is essential for pasture-production that a strain should show the ability to make year in and year out an abundance of new leafy growth immediately after grazing or mowing.

In this respect the true perennial alone fulfils the requirement. During the first nine months of the trials, Italian rye-grass beat the true perennial in recovery, but after the second hay-cut recovery of the true perennial was twice as rapid and complete compared with the Italian. At the peak of the Italian rye-grass growth this type produced in thirty-five days after the first cut as hay, 150 points, with Type 1 = 100; and at five days after the second hay-cut produced only 51 points, with Type 1 = 100.

The false perennials, particularly those of Types 4 and 5, failed badly to recover after each cut, and what recovery was made after the hay-cut was definitely of a stalky nature rather than leaf. The following observations made eleven months from sowing down and seven days after the second hay-cut on 17th February, 1930, give the relative recovery figure of the various types exclusive of Italian rye-grass (Type 6) that was contained as an admixture in certain of those lines. Type 1 gave best recovery = 100.

Type 1.	Type 2.	Type 3.	Type 4.	Type 5.
100	87	70	34	15

At no time during the year did the false perennials approach the true perennial in recovery, and this trait, taken in consideration with the low persistency of these types, marks the false perennial as the least desirable of all rye-grass types to grow. It scarcely outlives the Italian in persistency; it fails badly to recover after cutting, and its total yield is far below either that of the true perennial or the Italian.†

* In his paper "The Artificial Hybridisation of Grasses," Welsh Plant Breeding Station, Aberystwyth, Series H. No. 2, Mr. T. J. Jenkin, M.Sc., records 74·3 per cent. success in hand-crossing perennial and Italian rye-grass. These seeds germinated quite readily and produced vigorous plants. It had been further ascertained by Mr. Jenkin that the hybrid plants were equally self-fertile to average progeny plants of Italian or perennial crossed *inter se*.

† More detailed evidence on recovery of types will be given when dealing with single-plant studies in a subsequent issue of the *Journal*.

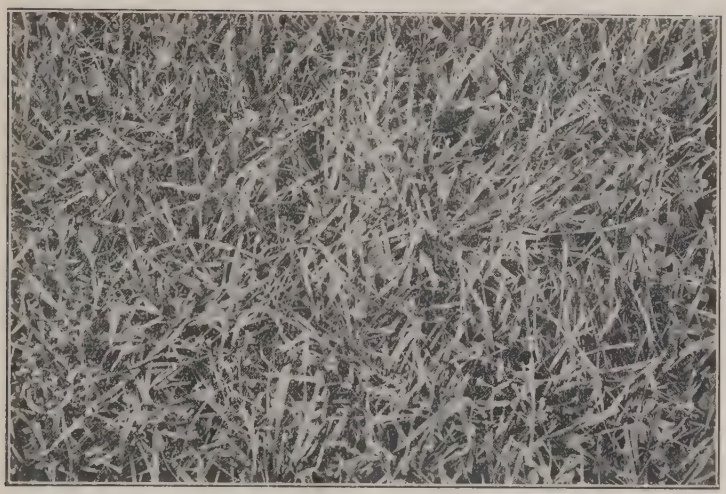

FIG. 6. SWARD PERSISTENCY, UNDER WEEKLY CUT, OF TRUE PERENNIAL (HAWKE'S BAY TYPE 1) AFTER TWELVE MONTHS.
This plot records 72 per cent. persistency.

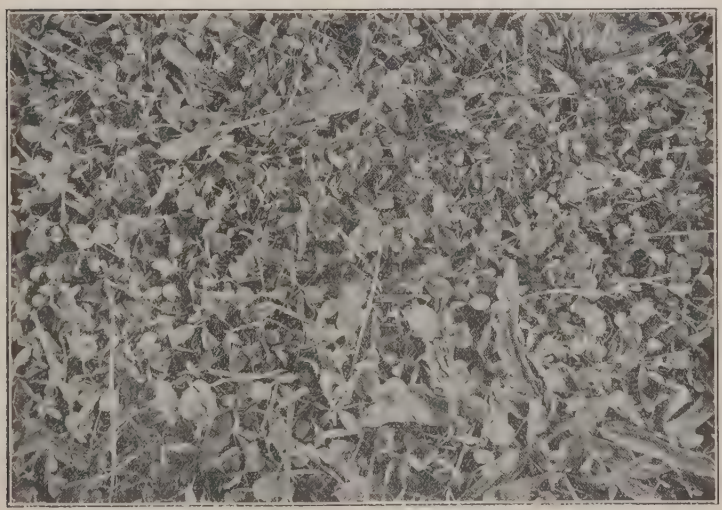

FIG. 7. SWARD PERSISTENCY, UNDER WEEKLY CUT, OF FALSE PERENNIAL (TYPE 5) AFTER TWELVE MONTHS.
This type averages 14 per cent. persistency. The plot shown is slightly below the average.
[*Photos by E. Bruce Levy.*

The high recovery figure for Italian rye-grass emphasizes the value of this species above all others for temporary-pasture work, but we would here stress the advisability of buying strongly-awned lines of seed, for it would seem that much of Type 5 finds its way on to the market as Italian rye-grass, and this type cannot be compared with Italian in production and ability to recover after grazing or cutting.

Swarding Characteristics of the Six Main Types.

The ability of a rye-grass to persist and sward out and completely cover the ground is one of the most important attributes of any type. A weak rye-grass that tillers but little, or one that relies on persistency by reseeding, will never make a good permanent sward, and certainly will never keep weeds out of a pasture. White clover, particularly under phosphatic manuring, often becomes much too dominant in a pasture, and this is certainly the case where a weak non-tillering, poor-swarding type of rye-grass is used.

The point-quadrat analyses in Table 6 show in average figures according to source of origin the state of the pasture sward within the same plots nine months and eighteen months respectively after the plots were laid down. In Table 7 are given similar results of some representative lines from different sources of origin sown in a further series of plots in the autumn of 1929. These analyses are arranged according to type, and both sets of analyses were made on the "weekly mown" portion of the plots.

Table 6.—Point-quadrat Analyses of Representatives of 104 Rye-grass Lines sown November, 1928.

Origin.	Average Hits per 100 Points examined.		Relative Persistency Figure with Average Hawke's Bay Seed = 100.
	After Nine Months.	After Eighteen Months.	
Hawke's Bay	41·6	25·6	100
Sandon	31·3	19·6	77
Wairarapa	31·2	10·4	41
Marlborough	29·0	7·0	27
Mid-Canterbury	28·2	7·0	27
Southland	29·7	7·2	28
Imported "Commercial" ..	30·6	4·6	18
South Canterbury	29·0	3·0	12

Table 7.—Point-quadrat Analyses showing Average Swarding-capacity and Persistency of the Representative Rye-grass Types under Weekly Mowing Trials (195 Lines sown March, 1929; 57 Lines critically examined).

Type.	First Analysis made at Six Months—Hits per 100 Points.		Second Analysis made at Twelve Months—Hits per 100 Points.		Percentage of Persistency of Rye-grass, 6–12 Months.
	Total Rye-grass.	White Clover.	Total Rye-grass.	White Clover.	
1 and 2*	72	2	34	40	47
3	75	2	26	36	35
4	78	1	17	57	22
5	83	1	12	55	14
6	71	1	6	57	8

One line only of Type 2.

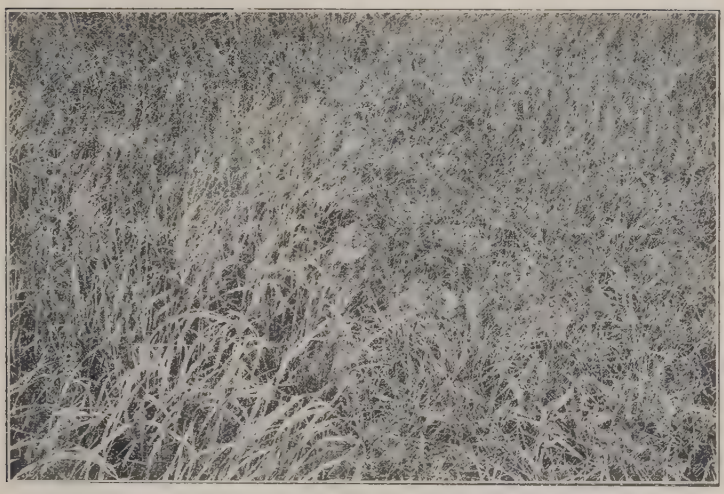

FIG. 8. RECOVERY OF FALSE PERENNIAL COMPARED WITH TRUE ITALIAN.

True Italian line on left; false perennial (Southland Type 5) on right. The false perennial does not recover so well as Italian after cutting, and in view of its low persistency is inferior to Italian for temporary pasture.

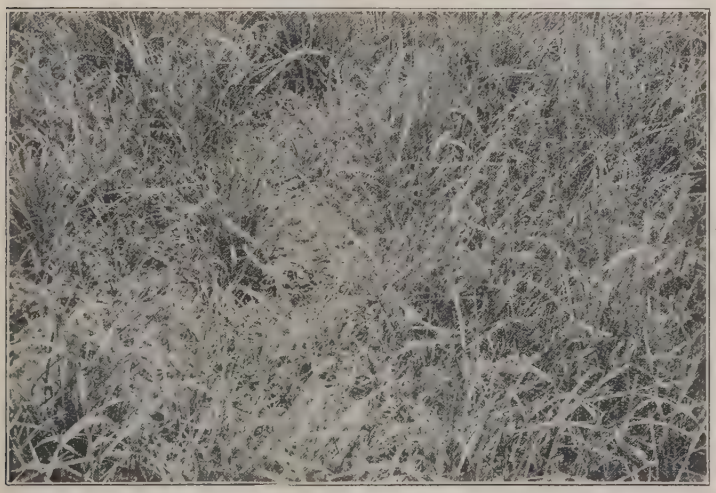

FIG. 9. RECOVERY, AFTER HAY, OF THREE TYPES.

True perennial (Poverty Bay Type 1) on right, Italian (odd outstanding plants) on left, and false perennial (rye-grass other than Italian) on left. The line on the left was a mixed false perennial and Italian rye-grass from the Wairarapa.

[*Photos by E. Bruce Levy.*

Viewing the above persistency figures some consideration should be shown in regard to the severity of the trial to which these turfs have been subjected. Weekly mowing with a lawn-mower is a severe test, not only from the point of view of clipping back the rye-grass but also from the strong competition that arises by the incoming and spread of volunteer white clover and weeds. As a matter of general interest the white clover figures have been included in Table 7, and it is interesting to note that the plots in which the weaker types of rye-grass were sown have on the whole run dominantly to white clover. No white clover was sown in laying down these plots. This state of affairs has without doubt been the experience of many farmers sowing down ordinary commercial rye-grass, and particularly under systematic top-dressing with phosphate.

Even among the genuine Hawke's Bay rye-grass there are low-persistency lines, but in no case have we met with extremes as shown in groups 4, 5, and 6. A few lines show very high persistency considering the treatment, and we have already initiated work at the Plant Research Station to reproduce as rapidly as possible a supply of seed (Line Ba. 12) for further experimental work, which we hope may ultimately form the nucleus of an elite persistent strain well above the standard of the present Hawke's Bay average lines.

In addition to the point-quadrat analyses presented in Table 7, eye determinations were made of the same plots at twelve months. The following figures are of interest as correlating the two methods of analysis :—

Table 8.—Showing relative Persistence and Excellence of Turf produced after Twelve Months' Weekly Mowing (Type 1 placed at 100).

Method.	Type 1.	Type 2.	Type 3.	Type 4.	Type 5.	Type 6.
Eye estimation ..	100	91	80	55	25	22
Point-quadrat ..	100	86	88	40	32	18

Whatever the method of analysis it will be fairly obvious that the true-perennial rye-grass types are from two to five times as persistent as the Italian and false-perennial types ; and the elimination of these latter from the seed trade and substitution by the former types must very rapidly lead to a marked improvement in the rye-grass position in New Zealand. True perennial rye-grass is so fundamental to economic grass-production that every step towards an improvement of existing strains must reflect itself in increased national wealth. The false perennials have no place whatever in the economy of New Zealand grasslands ; they have none of the advantages of a good Italian rye-grass on the one hand or of true perennial rye-grass on the other, while they have the disadvantages of both.

Resistance to Disease.

During the year the trials under study have shown that both broadcast plots and single plants belonging to the various types of rye-grass show marked differences in degree of resistance to rusts which attack both leafage and flowering-stem. From the pasture standpoint leaf-rust

FIG. 10. NEW ZEALAND AND IMPORTED LINES COMPARED: RECOVERY IN FOREGROUND AFTER HAY.

True perennial (Hawke's Bay Type 1) on left; false perennial (imported Types 4 and 5) on right. Cattle series behind labels.

FIG. 11. RECOVERY, AFTER HAY-CUT, OF IRISH "PERENNIAL" RYE-GRASS.

This line is a false perennial (Type 4) containing much Italian. Photo shows good recovery of the Italian and typical poor recovery of the false perennial. This figure and Fig. 10 emphasize the futility of trying to better our rye-grass position by wholesale importations.

[*Photos by E. Bruce Levy.*

(*Puccinia coronata*) is by far the most devastating in its effect. Stalk-rust (*P. graminis*) attacks the plant very late in the season, and may not be an important economic factor even in seed-production. Without exception during the season under review Type 1—true perennial rye-grass—as well as typical Italian rye-grass, was relatively highly resistant to rust-attack, whereas the false perennials were badly attacked by leaf-rust during the summer. The effect was general, both in the Plant Research Station area tests and in the field experiments, and was most noticeable in spring-sown plots. Table 9 is self-explanatory, and is based on spring-sown broadcast plots at the Plant Research Station on which accurate rust data were obtained.

Table 9.—Relative Rust-resistance of the Major Types.

Type.	Most resistant at 100.
True perennials	100
False perennials	36
Imported seed	35

It will be noted that imported lines of rye-grass were rather more susceptible to disease-attack than even the false perennials, and this was pretty generally the case throughout the experiments. Even the one or two apparently quite good perennial lines from British seed firms rusted badly under our local conditions. Rust-attack generally appeared early in December and was most severe during January and February. It would appear that rust-attack is closely associated with strain in rye-grass and is relative to the vigour of the type concerned. Just so soon as a type fails to maintain high vigour and stops growing as summer approaches it immediately becomes susceptible to rust. The more vigorous Hawke's Bay strain resists the attack until late in the season, whereas the weaker-constitutioned false-perennial types cease growth early in the season and immediately fall a prey to rust-attack. The production of young leaf well into the summer and as early in the autumn as possible, both by better utilization and stimulation by nitrogenous manuring, seems to be the key-note of success in reducing rust-attack on rye-grass. To accomplish this the use of the more vigorous true-perennial types is the major factor.

Palatability of respective Types.

A criticism of the Hawke's Bay rye-grass strain from the point of view of palatability is strong in the minds of many farmers in the South Island. There is no doubt that the rye-grass types vary in palatability in the early stages of growth, and this is well demonstrated by the results of grazing trials with eighty-five lines at Marton Experimental Area as recorded in Table 10.

Table 10.—Relative Palatability of Rye-grass Types at Eight Months after Sowing. (Most Palatable Type at 100.)

Type 1.	Type 2.	Type 3.	Type 4.	Type 5.	Type 6.
51	54	34	79	95	100

FIG. 12. PALATABILITY OF THE DIFFERENT RYE-GRASS TYPES.

View of grazing trials at Marton Experimental Area. In mid-foreground are two types—Type 6 on right and Type 3 on left. In mid-background Hawke's Bay lines, all Type 1, alternate with false-perennial types. In every case, irrespective of origin, the false-perennial annual types are eaten to the ground while the true perennials are less readily eaten.

FIG. 13. PALATABILITY OF THE SEVERAL RYE-GRASS TYPES.

General view of grazing trial, Marton, looking along a series of twenty-four plots of South Canterbury lines sown side by side. In mid-centre, immediately beyond sheep on right, is a Type 3 line approximating to a true perennial. This plot is neglected to the same extent as the Type 1 from Hawke's Bay. The sheep on right is standing on a Type 6 plot which is eaten to the ground; in the immediate foreground are two plots, both Type 4; behind the Type 3 plot is another run of false perennial. These false perennials are eaten almost as well as the true Italian, but are not recovering.

[*Photos by E. Bruce Levy.*

From these figures it will be seen that the straight-out Italian rye-grass (Type 6) is most palatable, and that those of Types 4 and 5 —the definite false-perennial types, which presumably have some Italian in their make-up—come next in the relative palatability scale, while the true perennials of Type 1 and the good types of false perennials of Types 2 and 3 fall off considerably in palatability. This was obvious in all the grazing trials undertaken in the field, particularly in the early stages of growth. The true perennials are firmer in the leaf, and apparently are not so palatable as the somewhat quicker-growing, laxer, and broader-leaved types. We concede this point to our critics, but we would like to point out that it is really not a question between the palatability of Hawke's Bay rye-grass and Canterbury or Southland rye-grass, but between one type of rye-grass and another. A true perennial rye-grass from Canterbury or Southland—and there are a few under trial—is neglected by stock in the presence of false-perennial types equally with the Hawke's Bay lines; conversely a dominant Italian rye-grass from Hawke's Bay is equally palatable to the Canterbury or Southland Italian, and much more palatable than the true-perennial types of those districts.

Again, in regard to types, palatability is relative according to the season of the year. Type 1, on recovery after cutting for silage or when the seed-heads are cleaned off during the summer period, throws definitely a greater proportion of leafage rather than stem, whereas the false-perennial and Italian types tend to throw up a second crop of seed-stalks At this stage the true perennials—throwing young leaf—are highly palatable, and the false perennials—throwing mainly stem—are less palatable.

Selective grazing by stock, again, is relative, and we may get in the same paddock with the same rye-grass type relatively high-palatability patches and low-palatability patches due to stage of growth. If a portion of the paddock is ever so slightly the more palatable—be that due to strain, manuring, utilization, &c.—those slightly more palatable portions under selective (light) grazing will be eaten and the rest of the paddock neglected. If the paddock is now spelled for a few days and stock are returned to it later, the previously sweeter and more palatable portions have made sweet young growth, which is again readily eaten, while the neglected portions have become increasingly unpalatable. Thus utilization under selective grazing may exaggerate as the season advances a degree of palatability slight only at the commencement of grazing. It may be noted here that all the palatability trials have perforce been limited to pastures not older than two years. It is not possible to compare the palatability of old pastures of true perennial rye-grass with those of false perennial, owing to the almost complete disappearance of the false perennial after about eighteen months.

The practical aspect of the palatability controversy that we would like to emphasize is this: so far as New Zealand commercial rye-grass is concerned, if a farmer sows two lines, A and B, in the same paddock side by side, and if the A portion of the paddock is eaten more readily than the B portion, this fact would plainly indicate that two types of rye-grass had been sown and that the A type is in all probability a false-perennial or annually-inclined type, and that the B type is a true

FIG. 14. TYPES OF SEED-HEADS OF THE THREE DOMINANT RYE-GRASS TYPES.
(1) True perennial (left), (2) false perennial (centre), (3) true Italian (right).
[*Photo by E. Bruce Levy.*

perennial and the more persistent type. As Table 10 would indicate, high relative palatability in the initial stages of the pasture-growth points clearly to the wrong type of rye-grass so far as the making of permanent pasture is concerned.

True perennial rye-grass is, after all, a highly palatable and nutritious feed, and one has only to visit the Hawke's Bay and Poverty Bay flats to realize what a boon it would be if those excellent, high-carrying, true-perennial rye-grass swards could be reproduced all over the better soils of New Zealand.

Our thanks are due to Messrs. Madden, Gorman, and Saxby, Assistants in Agrostology, for point-quadrat analysis data and general assistance in regard to these trials. The field staff under Mr. J. W. Todd, Farm Overseer, Plant Research Station, did faithful work in the care of plots and in conducting the mowing trials.

POISONING OF LIVE-STOCK.

SOME COMMON MINERAL AND PLANT POISONS.

C. V. DAYUS, M.R.C.V.S., District Superintendent, Department of Agriculture, Dunedin.

IT is by no means an easy matter to clearly define a posion. A common dictionary definition of the word is "that which is noxious to life." Guy states: "A poison is any substance or matter (solid, liquid, or gaseous) which when applied to the body outwardly, or in any way introduced into it, can destroy life by its own inherent qualities without acting mechanically and irrespective of temperature."

But there are many poisons that may do considerable harm without necessarily causing death. Lander gives another definition: "A poison is some substance which is acquired by the body in comparatively small amounts with harmful results, sometimes with death as a sequel." Gould's definition is: "A substance that being in solution in the blood or acting chemically on the blood either destroys life or impairs seriously the functions of one or more of its organs."

Strictly speaking, bacterial toxins, snake-venom, &c., are poisons, but it is not intended to attempt to discuss these in this article, which will be confined to the common mineral and plant poisons met with in New Zealand.

The location of the absorption of a poison has a distinct bearing on the degree of its effect. Poisons may be absorbed by any portion of the natural food-tract, by the respiratory tract, or through the skin. The food-tract is the most usual place for absorption to take place, chiefly through the stomach and intestine, on account of the more delicate lining membrane of these parts. As a general rule materials insoluble in water, in dilute acids or dilute alkalis, are not poisonous by the food-tract. This fact is observed in the selection of antidotal treatment, when materials are often given for the reason that they tend to render the specific poison less soluble.

Soluble poisons are easily absorbed by the respiratory tract, which is a very suitable channel if they acquire contact with it. The intact skin is generally an effective barrier against absorption, but the broken skin, such as small abrasions, wounds, &c., is quite a different matter. The appreciation of this point is an essential one on account of the extensive use in New Zealand of dipping and spraying fluids for lice and ticks. The majority of such fluids are roughly solutions of arsenical preparations or coal-tar derivatives with the addition of an alkali.

The addition of an alkali, while essential for the effective operation of the dip or spray fluids, also increases the penetrative powers of arsenic and phenols, and this is especially so if the solution is too strong. The reason for this addition is that the alkali saponifies and emulsifies the fatty nature of the normal skin secretion—that is, it converts it into a soapy emulsion.

If a poison does not actually destroy tissue and cause death by shock it does not exercise its effect until it has entered the general circulation. By this means it has to pass the natural barriers — the

liver and lungs. The liver arrests most metallic poisons and many alkaloids. An alkaloid is a nitrogenous compound occurring in plants, and generally the active principle. Many poisons, notably metallic poisons, since they are arrested in the liver are cumulative. But following the absorption of most poisons elimination is more or less rapidly commenced by the excretory channels of the body.

The well-known maxim "What is one man's food is another man's poison" serves to emphasize the rather important question of tolerance. In the case of some poisons an immunity may develop as the result of repeated small doses. Then there is the variation of tolerance in the different species to the same poison. For example, the ox is more sensitive to lead than the horse; but generally speaking the ruminant animal is more resistant to poisoning than the horse, dog, and cat. The action of morphia is well known: it induces stupor. In the cat, however, it has the exact opposite effect—an idiosyncracy not easily explained.

Poisons are roughly divided into the following classes:—

(1) Corrosives, such as the strong mineral acids, caustic soda, perchloride of mercury, carbolic acid in strong solution, &c. They act by actual destruction of the living cell.

(2) Irritants, such as arsenious acid (white arsenic), acetate of lead (sugar of lead), subacetate of copper (verdigris), sulphate of copper (blue vitriol, bluestone), silver nitrate (lunar caustic), bichromate of potassium, aloes, croton oil, &c., producing vomiting, delirium, &c.

(3) Narcotics: Drugs producing stupor, mostly drawn from the vegetable kingdom, such as opium, hydrocyanic acid (prussic acid), alcohol, chloroform, ether, chloral, &c.

(4) Narcotic irritants, forming a very large class, such as strychnine, foxglove, saffron, deadly nightshade, tobacco, yew, &c.

The poisoning of animals is generally brought about by their acquiring the poison by means of food and water, and occasionally through the broken skin. Cases of arsenical poisoning have occurred through dipping and spraying in both cattle and sheep. The fluid may have been allowed to drip from the animals and so contaminate foodstuff. Again, the directions on the makers' containers may not have been strictly adhered to. Poisoning of cattle has followed spraying them with some sheep-dips, in spite of the fact that the directions have specifically stated that on no account must the fluid be used for dipping or spraying cattle, horses, or dogs.

It must be borne in mind that sheep-dip solutions are as a rule much stronger than similar solutions used for cattle, horses, or dogs. This is so on account of the necessary penetration of the wool, and is possible with no attendant danger because sheep do not lick themselves. The majority of cases of mortality after dipping are due to defects in the process, including the following: (1) The dip is not made up according to the accepted strength as advised by the makers; (2) the dip is not stirred properly; (3) sheep are put through too quickly; (4) too long immersion; (5) sheep are driven before dipping or too soon afterwards, or dipped on a full stomach.

It is necessary to exercise great caution with dipping-fluids, as they are all poisonous; the trade designation "non-poisonous" applied to

some fluids is a fallacy. Many of the well-known proprietary dips are of standard uniform strength, are in universal use, and every safeguard is taken against any danger attendant upon their use, providing strict attention is paid to the directions, and the method of procedure carried out judiciously and correctly.

Lead poisoning is by no means uncommon, due to animals having access to freshly painted structures, and through old paint-tins and white-lead containers not being carefully disposed of. Cattle are notoriously inquisitive, and paint seems to have some added attraction for them. Lead shot from opened cartridge-cases has also been known to be responsible for poisoning.

The use of poisons to control vermin, notably those containing strychnine and phosphorus, accounts for some cases of poisoning of domestic animals. Caustic soda for cleaning dairy utensils has accounted for mortality, notably in pigs.

One of the commonest plant poisons is ragwort, due to continuous ingestion of the plant in districts where the natural pasture is extensively invaded by it. Another is tutu, which is not readily eaten unless the animal is suffering some degree of starvation—for instance, after being driven. A further instance is buttercup poisoning. Careless disposal of clippings from garden shrubs and plants is a source of trouble sometimes; they should always be regarded as unsafe. Poisoning from this source may be due to laurels, rhododendron, laburnum, yew, &c.

The amount of poison acquired naturally regulates the course which follows, and poisoning may be acute or chronic with possible intermediate degrees. In acute poisoning the symptoms are quickly noticeable and intense, with a rapid course and early termination. In chronic poisoning the result is produced by the cumulative effect of repeated doses, as, for example, in ragwort poisoning, though as a general rule cases of chronic poisoning are not common in animals.

Some of the Common Poisons.

Lead.—The source of lead has already been indicated. An oxide of lead commonly known as red-lead is used in painting and plumbing. A basic carbonate known as white-lead is used as a pigment. The cases of poisoning met with are commonly in cattle. The main symptoms of acute lead poisoning are gastro-enteritis, derangement of the nervous system, twitchings and convulsions, salivation and nasal discharge, and later blindness—an animal will stumble into any available obstacle; temperature nearly normal or below normal; coldness of the extremities, followed frequently by collapse, coma, and death.

In chronic lead poisoning, called "plumbism," in the human subject, which is of rare occurrence in animals, a characteristic blue line appears on the gums, with general digestive derangement. In cattle evidence of paint is frequently found after death in the third stomach, commonly known as the "book" or "bible." In treatment the primary step must be to stop the source of supply. Epsom or Glauber salts should be given; these are the sulphate of magnesium and sodium respectively, and by chemical action either tends to form lead sulphate,

which is insoluble. Bulk doses of tea or coffee with milk should then be given and the animal kept warm.

Arsenic. In dipping-fluids the alkali arsenite employed is generally sodium arsenite, which is easily soluble and the most poisonous of the ordinary arsenical preparations. The general symptoms of arsenical poisoning are salivation, thirst, colic, and a subnormal temperature with trembling, stupor, and convulsions. Death takes place sometimes very rapidly. There is a very marked stiffness in movement almost amounting to paralysis, especially of the hind limbs. Often portions of the skin assume a characteristic purply-blue colour, especially noticeable round the udder in a cow; later this area may undergo sloughing. This is comparable to arsenical eruption noted in man.

The chemical antidote is freshly prepared ferric hydroxide (an iron compound). In addition milk, white of egg, and lime-water in large quantities are useful.

Phosphorus.—Yellow phosphorus is the form met with in vermin-poisons. In New Zealand it is used in the manufacture of phosphorized pollard for rabbit-destruction. A peculiarity is that symptoms may be delayed some hours, even days after taking, as it is slowly absorbed. The symptoms are those of intense thirst and abdominal pain. Possibly the breath may be luminous in the dark. In pigs I have found free phosphorus in the stomach-contents several hours after death. Blue-stone is given as an antidote, it being supposed to remove the poison in the form of copper phosphide. In phosphorus poisoning any oils, milk, or anything of a fatty nature should be carefully avoided.

Strychnine.—Strychnine is one of the two chief alkaloids of the seeds of *Strychnos nux vomica*, an East Indian tree. The prepared drug is a white crystalline substance having an intensely bitter taste. It is extensively used in medicine as a tonic. Employed in New Zealand as a rabbit-poison.

Poisoning cases occur mostly in small animals, particularly dogs, but strychnine is also a source of danger to sheep and the larger animals. It acts on the central nervous system, and produces convulsive seizures followed by a period of relaxation. The symptoms are similar to those of lockjaw. Two or three grains would be sufficient to poison a sheep, and slightly less than half a grain to poison a dog.

In the case of a dog an emetic should be given. The best physiological antidote is choral hydrate. Others are tobacco and permanganate of potash. Needless to say, any attempt to antidotal treatment must be carried out rapidly.

Ragwort.—This poisoning is due to stock eating the common species of ragwort (*Senecio Jacobaea*) found in this country. It is the cause of so-called Winton disease in New Zealand, Pictou disease in Canada, and Molteno disease in South Africa. It is worthy of note that the major portion of the original investigation work into the poisonous effects of ragwort was carried out in New Zealand by Dr. J. A. Gilruth. As is well known, many areas of this country are badly overrun with the weed, and losses of stock due to its cause are by no means uncommon in those districts.

Ragwort poisoning has occurred in horses, cattle, and sheep, and roughly that is also the order of susceptibility. The plant contains

one or more poisonous alkaloids, whose chief function is to produce a slow chronic reaction in the liver, rendering that organ what is technically known as cirrhotic. Actually, instead of being friable the liver becomes paler than normal in colour, and hard. This is due to the destruction of true liver-cells and their replacement by coarse white fibrous tissue—a condition similar to that occurring in man in chronic alcoholic poisoning.

Having regard to the chronic nature of the condition, it will be easily realized that the process of liver-destruction has reached a fairly advanced stage before symptoms are shown by the animal. That the toxic principles are operative long after the ragwort has ceased to be a portion of the diet is frequently evident in many cases noted, often where an interval of three or four months must have elapsed before the first appearance of symptoms. Curative treatment is therefore practically out of the question. Symptoms appear gradually: affected animals become dull and lose condition; later the gait becomes staggery, and there is often a tendency to fall into obstacles—a period of intoxication. They gradually drift into a hopeless condition of semi-consciousness, eventually falling down and becoming unable to rise, and so death takes place.

Sheep appear to be more resistant than horses and cattle, but they also cannot be permitted to ingest ragwort indefinitely. They are often used successfully for keeping down the growth, and for this purpose it is most suitable to stock them heavily on ragwort-infested pasture in the spring. If sheep have been on ragwort too long without a change deaths may take place quite suddenly; these are notably increased if such sheep are driven distances. A condition of jaundice is often noticed during life, though not always, but there is considerable tendency for the carcass to assume a yellow appearance after death. This is due to the absorption of bile, and has nothing whatever to do with the fact that ragwort has a yellow flower, as is sometimes popularly supposed.

In consequence of the general hopelessness of individual treatment, work should be concentrated on means of effective control if not complete eradication of the ragwort. This must be an accomplished fact before poisoning from this cause will cease altogether.

Tutu.—This shrub (*Coriaria ruscifolia*) is commonly seen in the bush and on hillsides and banks in many parts of this country. As a rule stock do not eat tutu unless there is a shortage of natural feed. Poisoning is often noted after stock have been driven and then eaten the shrub on empty stomachs. The symptoms are those of excitement, with unsteady gait and nervous twitchings, and the animal is frequently blown. If discovered alive treatment is possible by relieving the blown condition by puncturing. Suitable medicinal treatment is the administration of 1 oz. of carbonate of ammonia dissolved in thin oatmeal gruel.

General.

There are a few other causes of poisoning of less importance, but space will not permit a detailed description of them here. Many of the types of symptoms are common to more than one

kind of poison, and it is sometimes difficult to diagnose a case specifically as being due to poisoning or not. But careful consideration of the points touched on should be a helpful means of avoiding errors and provide stimulation to greater powers of observation.

NOTE.—For detailed information regarding the indigenous plant poisons, a series of articles in the *Journal* entitled "The Poisonous and Suspected Plants of New Zealand," by P. C. Aston, may be referred to. The articles appeared in Volumes 16 (p. 324), 17 (p. 6), and 26 (pp. 78, 149, 230).—ED.

PLANNING OF THE TEST-ROOM AT DAIRY FACTORIES.

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THE writer has noticed in the course of his official travelling that in quite a number of comparatively new factories little thought has been given to the position or convenience of the test-room, especially to its lay-out. In the case of cheese-factories the tester has been placed on the open stage without hot or cold water nearer than the making-room, and where the operator has no control over temperatures, &c. In other cases the test-room has little or no drainage or is in conjunction with the starter-room, which is also in a bad position.

All test-rooms should have a suitable bath installed to read the tests from. This should have a steam-inlet to regulate temperature, and an overflow $5\frac{3}{4}$ in. from the bottom to ensure that the bottles cannot be submerged. Testers should be on a solid foundation, level concrete being the most satisfactory. If the concrete block is recessed this will provide a suitable cool and convenient place in which to keep the jar of acid that is in use. All test-rooms should be provided with an abundance of light.

Testing being a very important phase of the factory routine, the operator should have a test-room that is conducive to accuracy with the minimum of inconvenience. In the case of butter-factories the test-room should be as far as possible from churns, engines, &c., owing to vibration retarding or interfering with the sensitiveness of the delicate cream scales. If possible it is advisable to detach the test-room from the main building. With test-rooms of this description the operators find it better to carry the samples a greater distance than have their work retarded by noise of can-steaming, vibration of machinery, and incoming and outgoing of staff. It is not desirable that test-rooms be in conjunction with store-rooms, offices, &c.

It has been common in the past to place the tester in the corner of the test-room. This should be discouraged, owing to the small steam-pipes and nipples having to be replaced periodically. This work is much easier when the tester is in a central position, and in most cases it would be in a better light.

A satisfactory lay-out for the test-room from left to right is: (1) Sample-heating tubs; (2) scales; (3) burette for acid; (4) tester (central position); (5) hot-water bath; (6) washing-up tub, and rack for wet bottles. Composite sample-bottles, after washing, can be stored on shelf under bench away from light and in a cool position.

THE PURCHASE OF FERTILIZERS.

MEANING AND USE OF THE INVOICE CERTIFICATE.

F. T. LEIGHTON, Analyst, Chemistry Section, Department of Agriculture.

THE Fertlizers Act of 1927 provides that, for the information and guidance of the buyer, the seller of 5 cwt. or more of any fertilizer shall supply an invoice certificate setting out the nature and composition of the fertilizer and the percentage of each of the three recognized fertilizer-constituents—nitrogen, phosphoric acid, and potash. In framing legal measures it is necessary, in order that there shall be no ambiguity, to make use of certain scientific and technical terms the meaning of which is sometimes not understood clearly by the layman. Some questions that are frequently asked by farmers regarding the meaning of statements in fertilizer invoice certificates are dealt with in the following matter.

The invoice certificate states the name and brand of the fertilizer; the percentages of the fertilizer-ingredients nitrogen, phosphoric acid, and potash, and their solubility in water; the nature and proportion of each of the components of a mixed fertilizer, including any filler or diluent; and the fineness of grinding in the case of basic slag or rock phosphate. In certificates for basic slag and ground rock phosphate the seller may also state the percentage of phosphoric acid soluble in citric acid by the standard method of extraction. This, however, is optional, and since the invoice certificate is of the nature of a guarantee of quality by the seller this figure is very frequently omitted.

In the case of phosphates of any kind the essential ingredient is entered in the invoice certificate as phosphoric acid. In trade practice there is, unfortunately, a confusion of terms in respect to phosphatic fertilizers. The grade of superphosphate and of phosphatic guano is usually advertised, and branded on the bags, in terms of tricalcic phosphate (for instance, 44–46 per cent. superphosphate, 60–63 per cent. guano); while other fertilizers, such as basic slag, are graded in terms of phosphoric-acid content. One part of phosphoric acid is equivalent to approximately two and one-fifth parts of tricalcic phosphate. It will now be clear why, when buying 44 46 per cent. superphosphate, the farmer receives an invoice certificate showing it to contain about 21 per cent. of phosphoric acid. If basic slag were graded in the same way, a 17–20 per cent. slag would be sold as of 37–43 per cent. quality. In order to minimize this confusion of terms as far as possible the Fertilizers Act requires the quality of phosphatic fertilizers to be stated in the invoice certificate in terms of phosphoric acid only.

The statement of components in the invoice certificate is straightforward, and calls for little comment. It tells the buyer in just what form each of the ingredients of the fertilizer has been added; whether, for instance, the soluble nitrogen is there as nitrate of soda or as sulphate of ammonia, the phosphoric acid as bone phosphate or ground rock phosphate, &c. It also informs him what, if any, filler has been added, and in what amount. A filler or diluent is any substance, other than a fertilizer, that is added to a fertilizer or mixture of fertilizers. A filler, however, is not necessarily an adulterant. Such a substance

as carbonate of lime may be used to improve the mechanical condition of the mixture and enable it to run easily through the drill. Occasionally excessive amounts of filler are used; mixtures containing about half their weight of ground limestone have come under notice, the percentages of the active fertilizer ingredients being, of course, proportionately reduced. On the other hand, some manufacturers use no fillers in their mixtures, the desired granularity being obtained by using suitable proportions of ground rock phosphate, or by other means.

The fineness of grinding of basic slag and ground rock phosphate is shown in the invoice certificate, the figure indicating the percentage of the fertilizer that will pass through a standard sieve having 10,000 holes to the square inch. A minimum fineness of 80 per cent. is required by the Fertilizers Act regulations.

Statement of Solubility.

Figures indicating the solubility of fertilizer ingredients appear to perplex many farmers. The solubility of nitrogenous fertilizers is not difficult to understand; such fertilizers as nitrate of soda and sulphate of ammonia contain water soluble nitrogen, while the nitrogen of animal fertilizers is in the insoluble form. Generally, no alteration in solubility occurs when nitrogenous fertilizers are used in mixtures (the addition of lime, however, will result in the loss of nitrogen from ammonia compounds and animal fertilizers). In the case of potassic fertilizers, only water-soluble potash compounds are recognized as fertilizers, and these also do not alter in solubility when incorporated in the usual mixtures. Phosphoric acid may be recorded in the invoice certificate as soluble in water, insoluble in water, or soluble in citric acid. The usual source of water-soluble phosphoric acid is superphosphate, although some of the new concentrated fertilizers contain soluble compounds of phosphoric acid with nitrogen or potash.

It is sometimes asked why an invoice certificate of a mixed fertilizer shows little or no water-soluble phosphoric acid, although the statement of components shows that a fair amount of superphosphate is present. The reason is that the water-soluble phosphate changes (reverts) more or less to a form that is insoluble in water but is still easily soluble in weak acids and is readily accessible to the plant. The well-known basic superphosphate is an instance of the water-soluble phosphate being reverted deliberately, by the addition of lime. Since this reversion of soluble phosphoric acid goes on slowly from the time the fertilizer is mixed, the manufacturer in his invoice certificate allows for the maximum reversion that is likely to take place, and records the soluble phosphoric acid on the low side. Actually, unless lime has been used as filler, there is not usually much reversion if the fertilizer is used reasonably soon after mixing.

The solubility in citric-acid solution (citric solubility) is the cause of considerable confusion of mind, on account of the practice of some sellers of quoting figures showing the citric solubility of their fertilizers by "modified" methods. Citric solubility is determined by shaking for a definite time a mixture of definite quantities of fertilizer, citric acid, and water. By varying the respective quantities and the time of solution, varying degrees of solubility can be obtained. It is necessary, therefore, to have a standard method of procedure in order that solubility results may be compared. The Fertilizers Act regulations

prescribe the official method, and it is provided that when the citric solubility of a fertilizer is included in the statement of analysis (invoice certificate) it shall be determined by the official method. Therefore, when fertilizers are advertised as of high citric-solubility by a modified method, it should be understood that the solubility figure cannot be included in the invoice certificate, and that no action can be taken under the Fertilizers Act in respect to any guarantee of quality that is not incorporated in the certificate.

The citric-solubility test was devised for the valuation of basic slag, and it is still of considerable use in estimating the probable comparative values of different slags. With the development of the sale of finely ground rock phosphates in competition with basic slag it was found that the official method as applied to slag gave results which, it was claimed, did not truly represent the comparative availability of the phosphates. Several modified methods of extraction were proposed, some using a very small amount of fertilizer to a very large amount of weak citric-acid solution, others making use of other weak acid solvents. The effect was to increase the solubility of the phosphoric acid from two to seven or eight times that obtained by the standard method. As these methods have not so far definitely been proved to give a reliable indication of availability they have not been recognized by the Fertilizers Act.

The solubility of basic slag and rock phosphate is in general influenced to a considerable extent by the fineness of grinding of the fertilizer, and, with the modern methods of grinding phosphate rock, fertilizers are obtainable which give a fairly high solubility by the official method.

Unit Values.

The Fertilizers Act no longer requires the "unit values" of fertilizer ingredients to be stated, but as this system of valuation is still made use of for advertising purposes (and in the trade as a basis of purchase) a short explanation of the method may be useful.

A "unit" of a fertilizer ingredient is 1 per cent. of 1 ton (that is, 22·4 lb.). Basic slag containing 17 per cent. of phosphoric acid contains 17 units of that ingredient, and if the price is £5 per ton the price per unit (unit value) will be £5 ÷ 17, or 5s. 11d. This system makes it easy to compare different quotations for the same kind of fertilizer where the quality and price both vary. Suppose, for example, that two lines of basic slag are under offer:—

> A is quoted at £5 per ton for 17–20 per cent. quality.
> B is quoted at £5 12s. 6d. per ton for 20–22 per cent. quality.
> Then the unit price of A is found to be 5s. 11d., while that of B is 5s. 7d.

Assuming that the solubility and fineness of grinding are approximately equal, it is clear that the higher-priced fertilizer is cheaper by 4d. per unit than that which is offered at the lower price per ton. Similarly the cost of mixed fertilizers can be compared by assigning the current unit value to each constituent and multiplying each percentage by its unit value.

The mistake should not be made of attempting to compare the unit values of unlike fertilizers. Comparisons are sometimes made between the unit values of such widely different types of phosphate as superphosphate, basic slag, and raw rock phosphate. No useful information can be obtained in this manner.

RURAL FINANCE IN NEW ZEALAND.

THE INTERMEDIATE CREDIT SYSTEM AND LONG-TERM ADVANCES.

Paper presented by J. J. Esson, C.M.G., Chairman, Rural Intermediate Credit Board, to the Empire Farmers' Conference, held at Wellington, 24th March, 1930.

THERE is probably no country in the world where better provision exists in the credit system for primary producers than in New Zealand, both as regards short-term and long-term loans, or where greater opportunities are afforded the industrious farmer with small capital. I say "small capital" advisedly, for whilst personal ability, character, and experience are essential, it is imperative that the farmer himself should contribute a certain amount of the capital required in his business. It is the only buffer between his creditors and loss, and he should constantly endeavour to maintain his equity unimpaired, for when "sailing too close to the wind" he is in serious trouble directly prices fall.

In recent years there has been a large increase in the number of lending institutions, which has not been an unmixed blessing. Credit has its disadvantages as well as its advantages, for when it is too easily obtained it becomes a temptation to overspend and to borrow injudiciously. Indeed, our experience has shown that in the past credit was often too easily obtained, and money was borrowed without due regard to its profitable employment. Values were much inflated during an abnormal period of high prices. Land was bought at impossible prices, stocked and cultivated on credit by farmers, many of whom added to an overwhelming liability by the purchase of costly machines, motor-cars, and suchlike on the instalment plan.

New Zealand is still recovering from that stage; and although a liberal lending policy is observed, that liberality is checked when the applicant, although he may be a good moral risk, is burdened with liabilities and charges which cannot possibly be met out of the income of his farm, or when it is sought to be taken advantage of to cover personal extravagance, negligence, or speculation in land and stock instead of practical occupational farming.

There is less room to-day in the rural credit system for the speculator, who regards farming as an opportunity, not as an occupation, and it is becoming understood that the true value of land is not found in its selling-price but in its productivity, its lasting-qualities, and average annual return, or that its earning-power determines its loan value.

Here as elsewhere there is the same urgent demand for credit in periods of adversity, when it is sought as a desperate remedy; but no institution, whether State or co-operative, can afford to make loans which prudent investors would reject as hazardous and excessive. Every effort is, and should be, made to foster our primary industries and to improve the conditions and prospects of those upon the land, but it has to be recognized that unlimited credit will not help farmers when unprofitable prices prevail, for it would only be adding to their burden

of liabilities. It is an axiom that cheap money cannot restore price-levels. The only consideration must be how much credit can be profitably employed or be profitable for the farmer to borrow.

The main sources from which the New Zealand producer obtains credit are (1) the commercial banks; (2) private companies, stock and station agencies, &c.; (3) State or State-fostered organizations. For short-term loans the two former have rendered and continue to render great assistance to the primary producers; in fact, they have established "a service which through long usage and custom has become almost indispensable," and, considering the cost of supervision and the risk run generally, their interest rates are not unduly high.

Time, however, will only permit me to give a general outline of the State and State-fostered organizations, which are obviously designed to benefit the small farmer rather than the larger landholder. The latter can usually finance on reasonable terms; for instance, one of our leading commercial banks recently instituted a long-term reducible mortgage, an example which is being followed by other large lending institutions.

Long-term Advances.

The State Advances system, providing for long-term loans on farm lands on the amortization plan, was created by the Government Advances to Settlers Act, 1894, under which a Government Advances to Settlers Office was established. Its purpose was to assist agricultural development by providing capital for settlers at reasonable rates of interest. The preamble to the Act read as follows: "Whereas by reason of the high rates of interest charged on mortgages on land, and the heavy incidental expenses connected therewith, settlers are heavily burdened and the progress of the colony is much retarded: And whereas it is expedient that the Government should afford such relief in the premises as is consistent with the public safety: Be it therefore enacted," &c., &c.

The new Department was authorized to make loans not exceeding £2,500 to individual borrowers on three-fifths of the value of freehold land, and up to one-half of the borrower's interest in leasehold land. The loans were repayable over a term of thirty-six and a half years. Loan funds were to be provided by the sale of Government debentures or stock, which nominally increased the public debt of the Dominion but against which the first mortgages held by the Advances Office provided an ample set-off.

It is hardly necessary to stress the advantage possessed by this method of finance when compared with the old way of borrowing on a flat mortgage for five, seven, or ten years, which made it very hard for the farmer, who during periods of financial stringency sometimes lost his farm because he could not get his loan renewed.

Amortization worked wonders for the settler who secured a State Advances Office loan. He was relieved of the fear of foreclosure, and the reduced interest lightened the drag upon his income. The expense of renewing his mortgage every few years no longer had to be met, while the right to repay the whole or practically any portion of the loan at any time placed him in an even more favourable position. Added to all this is the fact that he is steadily year by year improving his position in the way of reducing his capital liability by regular payments

which are not sufficiently large to be burdensome. The operation of the Act has also benefited farmers who are not borrowers from the State Advances Office, because shortly after it became law the interest rates charged by other agencies were materially reduced.

The fear was expressed that the State would in time become the sole mortgagee, but this has proved groundless so far as the farming community is concerned. The State systems have proved regulative rather than competitive, as the bulk of the farmers continue their old business connections, but certainly under more favourable terms.

To bring the Act into operation arrangements were made for a loan of £1,500,000, and such was the demand that at the end of 1928–29 the amount owing to the Settlers Branch on mortgages on rural lands was £12,958,433. Under the Rural Advances Act of 1926, which further extended the facilities to farmers, an additional amount of £1,875,285 had been advanced up to the end of the financial year 1928–29.

Since the inception of the Act there have been various amendments with a view to making its benefits available to as many farmers as possible. The legislation is now embodied in the State Advances Act of 1913 and its amendments, also the Rural Advances Act of 1926, which constituted a fresh branch of the Advances Office. The Rural Advances Act was passed following the report of a Royal Commission on Rural Credits which was appointed in 1925 to investigate the system of rural credit in different countries.

At present the maximum advance which may be made to any applicant is £3,500 under the Advances to Settlers Branch and £5,500 under the Rural Advances Branch, the margin of security required being 25 per cent. under the former and 33⅓ per cent. under the latter. Loans may be granted for twenty years, thirty years, or thirty-six and a half years. The example set by the Legislature has been followed by other lending agencies, and a considerable portion of the money now advanced by other Government Departments and outside financial institutions is loaned on long-term mortgages repayable by instalments.

Funds for the Rural Advances Branch are obtained by the sale of bonds secured upon the collective mortgages, but as both interest and principal are repayable to lenders out of the Consolidated Fund they are to all intents and purposes instruments of State.

Intermediate Credit.

In addition to the system of long-term credit provided by the State Advances and Rural Advances Acts, further effect was given to the recommendations of the Royal Commission, already referred to, by the Rural Intermediate Credit Act, 1927. Briefly, intermediate credit is credit given for a longer period than is contemplated in commercial transactions and of shorter duration than the usual mortgage term. It enables the producer to meet his seasonal requirements without embarrassment, as it covers farm credit for periods ranging from six months to five years, and is secured upon farming stock and chattels, and non-perishable farm products.

The State Advances Amendment Act of 1922 contained authority for advances up to £500 on the security of farm stock and chattels, but its administration was centralized in Wellington, and in the absence

of local machinery it was not availed of to any great extent. Another provision, the Rural Credit Associations Act, in the same year, empowered farmers to join together for the purpose of securing accommodation upon their available assets with a joint-and-several liability. This was fatal in itself, and as no central organization was set up to provide funds for investment upon the members' securities no associations were formed.

The burden of financing the primary producers in the development of their holdings and during the periods of low prices thus devolved upon the banks and the stock and station agencies, whose action in providing what was in effect a system of intermediate credit was really outside their essential activities and anything but a profitable part of their business.

The outstanding feature until recent years was the lack of a central organization for attracting a flow of capital for investment in farm securities. In New Zealand, as in other parts of the world, secondary industries, commercial and business undertakings of all kinds, had through the development of the joint-stock company form of enterprise absorbed in constantly increasing extent the savings of the community, and primary industry suffered in consequence. Experiences during the recurring periods of low prices in connection with investments upon individual farm units had also tended to weaken confidence. It was evident that some steps were urgently required to organize and co-ordinate farm credit in order to make it attractive to those who wished to lend money at a reasonable rate on proper security, and to provide a loan currency which would conform to the requirements of seasonal production.

The Act of 1927 was the outcome, and one of its prime objects was to restore the confidence of investors and thus secure a flow of capital for investment upon rural securities, such as stock, produce, and other chattels at reasonable rates of interest.

The administration of the system is entrusted to an independent Board of eight members, three of whom are statutory—namely, the Financial Adviser to the Government, the Superintendent of State Advances, and the Public Trustee, who is the Commissioner of Rural Intermediate Credit; the remainder are appointed by the Governor-General in Council, and consist of practical farmers and men with long experience of New Zealand banking, finance, and merchandizing. Sixteen subsidiary or district boards, consisting of five members each, have been appointed by the central Board. The District Intermediate Credit Supervisors in each district act as the local representatives of the central Board and are *ipso facto* members of their respective district boards. The boards are fully representative of the various classes of the community interested in rural finance. The detail work is carried out by the Public Trust Office organization as agent for the Board, and the branch officers of the Public Trust Office throughout the Dominion act as the local representatives of the Board, those in the more important centres acting under the designation of District Intermediate Credit Supervisor, with definite statutory powers and duties.

Finance.

Initial funds for investment by the Rural Intermediate Credit Board were provided by an advance of £400,000 from the Consolidated Fund

free of interest for the first ten years, one-third to be placed to the credit of a special redemption fund for the purpose of redeeming debentures issued by the Board, and the remaining two-thirds to be available for making advances as permitted by the Act. Grants were also made to the Board up to a total of £10,000 to cover the expenses of establishment and the preliminary cost of administration. The permanent and main source of the Board's funds for investment will be the issue to the public of debentures secured upon its assets and by the provisions of the Rural Intermediate Credit Act of 1927. These debentures will, in effect, have priority over the claims of the Crown to repayment of the advance of £400,000, as repayments to the Crown are restricted so that they may not exceed in total the amounts transferred to the reserve accounts of the Board. The total of the debentures issued by the Board may not at any time exceed the sum total of the advance from the Consolidated Fund and the amount of the investments of the Board, or the sum of £5,000,000, whichever is the less.

Methods of Loans by the Board.

The funds provided are made available to the farming community by four methods, providing ample scope for co-operative effort upon the part of farmers in relation to their credit requirements.

ASSOCIATIONS.

The first of these methods is by advance to farmers as members of a special form of limited-liability company known as co-operative rural intermediate credit associations. The Act enables farmers to combine for the purpose of financing themselves as individuals on their collective financial strength, as a group. The procedure briefly is for a group of farmers of not less than twenty in number to form an association, and the Board is authorized to advance funds to the association, to be loaned by the association to its members upon approved securities. Farmers who subsequently desire to apply for loans through the association may be admitted as members, and members who have repaid their loans, or do not propose to lodge applications, may be permitted by the directors to retire and may receive the agreed value of their shares, provided that their retirement will not reduce the membership of the association below the statutory minimum.

The minimum share capital which a member must contribute is twenty-five £1 shares, and a shareholding of this amount will permit a member obtaining a loan up to £250 if his security is considered sufficient. A member desirous of obtaining a larger loan must take up shares to the nominal value of one-tenth of the amount of the loan, and consequently a member's shareholding may range from £25 up to £200 in the case of the maximum loan of £2,000. Members of associations are not liable for the loans obtained by other members beyond the amount of the share capital which they have subscribed.

Associations are not intended to be trading bodies or profit-making concerns, and are subject to certain statutory restrictions imposing safeguards considered necessary by reason of the fact that they will mainly be debtors of the Board, which in turn is trustee for the debenture-holders who have invested their funds in the Board's business, and for the Crown in respect of funds advanced on loan from the Consolidated Fund. On the other hand, it has been possible to

exempt the associations from charges levied in the case of commercial companies, and the procedure with regard to their formation and working is much simplified. The Board may also make advances to associations up to £25 each to meet the preliminary expenses incurred in their formation. Such advances are made by way of loan free of interest for periods up to ten years.

The maximum amount of loans which may be granted to members of associations was fixed by the Rural Intermediate Credit Act of 1927 at £1,000, but by an amending Act in 1929 the limit was increased to £2,000. The purposes for which loans may be granted are defined by the Act, and include mainly the improvement of the farm property (including the erection of buildings), the purchase of implements, stock, seeds, and similar farm requirements, the payment of mortgages, debts, or other liabilities incurred in relation to farming operations, and generally any such purposes approved by the Board. The Act also provides that loans should be granted on a reducing basis, the instalments being fixed by the Board to suit the requirements of the various classes of loans. The Board has fixed its interest-rate at 6½ per cent. per annum, and this rate is charged upon the daily balance of the loan accounts. The securities taken are mainly mortgages of farming stock and chattels, with, in suitable cases, collateral security over the farm properties.

Up to the present twenty-eight co-operative rural intermediate credit associations have been formed in various parts of the Dominion, thus providing farmers in a large number of districts with the opportunity of approaching the Board for loans upon their live-stock and chattels and other farming assets. Up to the present associations have been formed mainly in dairy-farming districts, but with the recent increase of the limit for loans, and the introduction by the Board of a new system for advances in connection with sheep and grain securities, increased activity in the formation of associations in sheep-farming districts is anticipated.

LOANS DIRECT TO FARMERS.

The provision for loans direct by the Board to farmers did not appear in the Bill originally submitted to Parliament providing for an intermediate credit system, but were introduced by a special parliamentary committee set up to consider the Bill, and on which farming interests were extensively represented. These provisions enable a farmer to apply direct to the Board for an advance, provided he is able to arrange a guarantee satisfactory to the Board for such amount as may be required by it, being not less in any case than 20 per cent. of the original amount of the loan, the collateral security afforded by this guarantee replacing the collective responsibility of an association for advances made by the Board to its members. The addition of this alternative method provided for the development and extension, with adequate safeguards, of the existing facilities under which loans on chattel securities could be obtained under the State Advances system.

The conditions with regard to the maximum amount of loans, the purposes for which loans may be granted, the rate of interest chargeable, and the repayment of the loans which have been set out in regard to association loans apply to direct loans granted by the Board. The securities are generally of the same nature as those taken in connection with association loans, with the additional security of a guarantee as required by the legislation.

Most of the loans issued by the Board direct to farmers have been granted with the guarantees of dairy companies — co-operative and proprietary. Up to the present forty-nine companies have made arrangements with the Board for the acceptance of their guarantees of loans. The bulk of these companies are co-operative dairy companies, so that their utilization of the provisions of the Act for direct loans has the same practical effect as the establishment of associations among their suppliers.

DISTRICT BOARDS.

The majority of the applications for loans of £250 or under submitted either through associations or direct to the Board are dealt with and granted or declined by the district boards. The district boards also consider all direct applications in excess of that sum, and submit recommendations regarding them for the guidance of the central Board. The tendency is to gradually increase the powers of the district boards.

In addition a number of matters affecting the administration of direct loan accounts, such as applications by borrowers for readvances for necessary purposes of sums received from the realization of stock and produce or from other sources, are dealt with by committees of the district boards composed of the District Supervisor and at least one other member of the district board.

LOANS TO FARMERS' CO-OPERATIVE ORGANIZATIONS.

Advances are also made to farmers' co-operative societies upon the security of live-stock or produce. To be eligible to receive a loan a co-operative society must be engaged in the production or sale of staple agricultural or pastoral products, including live-stock and goods manufactured from any such produce, must have a subscribed capital of not less than £2,500, and be composed of not fewer than thirty members.

DISCOUNTING.

The central Board is also authorized to discount farmers' promissory notes or bills of exchange which are endorsed to the satisfaction of the Board. The maximum amount available to a farmer by this method is £200, and the amount of any other loans which he may have obtained from the Board has to be taken into account to ensure that the total accommodation provided for him does not exceed the limit of £2,000 fixed by law. The discount rate is 6½ per cent., and the period for which advances are made in this method is restricted to one year, or in special cases two years.

The discounting method is utilized mainly by dairy companies desirous of assisting suppliers to finance their minor seasonal farm requirements, such as manure and seeds, and small purchases of stock. The dairy companies usually arrange for a deduction from the milk or cream cheques of suppliers for whom they have discounted notes, in order that they may be in possession of sufficient funds to meet the notes on maturity. Where a dairy company is discounting a large number of notes with the Board the monthly deductions reach a considerable total, and in such cases the Board permits the company to retire promissory notes prior to maturity and allows a rebate of interest, but insists that this saving of interest must be passed on to all the suppliers affected. In these circumstances borrowers will be paying 6½ per cent. only on the amount outstanding on account of their loans from month to month.

Up to the present thirty-seven companies have made arrangements with the Board to accept their endorsements of promissory notes for discounting with the Board. The method of fixing limits for companies is identical with the procedure in connection with the limits imposed in respect of guaranteed loans.

SHEEP AND GRAIN SECURITIES.

Up to the present the scheme has been utilized mainly by the dairying industry, the loans granted to other classes of farmers such as sheep-farmers and grain-growers being limited in number and amount. This is due to a number of special causes. In the first place, the limit of £1,000 fixed by the principal Act proved insufficient for the requirements of sheep-farmers and grain-growers during the period when no revenue is forthcoming and the expenses associated with farming operations have to be met. In the second place, sheep-farmers did not have at their disposal the same facilities for obtaining guarantees of loans as dairy-farmers with their dairy companies behind them, and consequently were not able to utilize the provisions of Part III of the Act to the same extent. In the third place, the system for fixed loans to be liquidated over a period of years, although suited to the requirements of dairy-farmers, was not applicable to the circumstances of sheep-farmers, whose indebtedness steadily increases during the major portion of the year and is then rapidly liquidated either in whole or in part.

In view of the fact that sheep-farmers may be expected to approach the Board mainly through the medium of associations, the introduction of this system is expected to stimulate the formation of associations in sheep-farming districts.

General.

Each country has its own peculiar financial and seasonal difficulties, but the problem in each is how to discount farm securities at the lowest possible rate. It is generally agreed that the solution is not to be found in the duplication of existing institutions, but in organizing the resources of the primary producers themselves, so as to provide a basis for joint concerted action in their own behalf in order to get the capital they must use.

"The development of the group system gives the farmer the experience which teaches him to use money in a business way, leading ultimately to financial independence, by putting him in direct relationship with a self-supporting institution through which capital can be obtained. In combination farmers can command capital, credit, technical advice, and commercial attention. The fact that the resources and responsibility of several individuals are combined together increases the confidence of lenders and creates an asset which is equivalent to the asset of goodwill upon which corporate industry relies."

This possibility exists in New Zealand, where the co-operative spirit is well developed. The State and State-fostered schemes are established on a sound basis with adequate provision for administration and losses. They have brought the borrowing farmers into closer relationship with the lenders, and money is borrowed and loaned at cost price, but that price is governed by inexorable laws, and can only be reduced by the

willingness of farmers themselves to undertake certain services and responsibilities, which they can do with little or no financial risk when properly organized. In New Zealand they have the opportunity and are taking advantage of it.

NOTE.—In regard to the foregoing paper the writer acknowledges his indebtedness to various reports and publications, which have been freely drawn upon to set out the position in New Zealand.

FEEDING OF IODINE TO POULTRY.

SOME LOCAL EXPERIMENTS AND RESULTS.

B. W. SIMPSON and R. STRAND, Chemical Laboratory, Department of Agriculture, Wellington.

IT has been shown experimentally that the addition of iodine to the food or drinking-water of fowls will add at least one year to the productive life of each hen. Not only so, but it has been reported from British Columbia that in certain cases hen-eggs, though fertilized, failed to hatch out; when iodine was introduced into the diet the trouble was removed. The administration of iodine to laying hens also results in an increased iodine content of the eggs, making iodized eggs a valuable food item for those who cannot take iodine in the usual way.

The experiments recorded in the following matter were carried out in the Hutt Valley, near Wellington. Some White Leghorn fowls, about four or five years old, were fed potassium iodide in increasing doses in the drinking-water through the spring and summer of 1929–30. In their second and third years these birds had been good layers. Before starting iodine feeding they were moulting and not laying at all, but after iodine feeding was commenced they laid more eggs than was expected of hens of that age. They also appeared to be healthier, moulted completely, and quickly regrew their feathers. Eggs were collected from these hens, incubated, and hatched out. All the eggs were fertile, and 85 per cent. were pullets.

There were nine hens. The potassium iodide was weighed out for them and put in the drinking-water trough. The dose was 2 milligrams of potassium iodide per hen per day, but of course they did not all drink the same amount of water. The hens had this dose for three weeks from 1st June. The dose was then doubled, and the hens received 4 milligrams of potassium iodide each per day up to 21st August, 1929.

The results are shown in the following table. In each case the eggs were weighed without the shells.

Table 1.

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.
	Grammes.	Gammas.*	Gammas.*
3/7/29	50·4	568	1,127
28/7/29	52·6	212	404
21/8/29	52·2	213	407

* Gamma = one-millionth of a gramme.

Normal (non-iodized) eggs from the same place gave the following iodine content :—

Table 2.

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.
	Grammes.	Gammas.	Gammas.
1/7/29	45·4	6	14
29/7/29	53·8	8	14
23/8/29	48·9	13	26

Iodine feeding was continued from 21/8/29 to 9/10/29, each fowl getting 8 milligrams of potassium iodide in the drinking-water per day, with the following result :—

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes
	Grammes.	Gammas.	Gammas.
9/10/29	56·6	425	754

A normal egg for comparison gave—

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.
	Grammes.	Gammas.	Gammas.
12/10/29	52·2	14	26

The iodine was now stopped and no iodine fed for a fortnight previous to 3/11/29. The result is shown in the following analysis :—

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.
	Grammes.	Gammas.	Gammas.
5/11/29	53·0	43	80

From 3/11/29 to 18/12/29 the hens were getting approximately 16 milligrams of potassium iodide each per day, from 18/12/29 to 22/2/30 64 milligrams, and from 22/2/30 to 29/3/30 128 milligrams.

The hens were killed in the beginning of April. For a few days previous they were getting 256 milligrams of the iodide per day, this being approximately 3 grains of iodine. Three grains is the dose quoted as being the optimum. One egg was found in the oviduct of one of the hens after it was killed. Table 3 (opposite page) gives the further results.

Hercus and Roberts (*Journal of Hygiene*, Vol. 16, No. 1, 30th March, 1927) by a similar experiment increased the iodine content of eggs from 4 gammas to 880 gammas per 100 grammes in a fortnight. Three weeks after the discontinuance of the treatment the iodine content dropped to 14 gammas per 100 grammes.

Table 3.

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.	Dose of Potassium Iodide per Hen per Day.
	Grammes.	Gammas.	Gammas.	
18/12/29	54·0	520	964	16 milligrams.
22/2/30	51·4	1,105	2,150	64 milligrams.
22/2/30	49·3	10	19	*
26/3/30	55·3	807	1,461	128 milligrams.
29/3/30	42·6	1,057	2,483	128 milligrams.
29/3/30	58·1	956	1,645	128 milligrams.
23/3/30	44·7	12	26	*
27/3/30	44·9	16	36	*
2/4/30	37·9	2,231	5,887	256 milligrams (egg from oviduct).

* Normal egg—no potassium iodide fed.

The iodized hens were killed and weighed. The thyroid glands were dissected out and weighed, and the iodine content estimated. Two normal hens were treated similarly. Two pullets six months old hatched from iodized eggs were also killed, weighed, and the thyroids dissected out and the iodine content estimated. Two normal pullets were treated similarly. Table 4 sets out the results.

Table 4.

Date.	Description.	Weight of Hen.	Age of Hen.	Weight of Thyroid.	Iodine in Thyroid.	Percentage of Iodine.
		lb. oz.		Grammes.	Grammes.	
2/4/30	Iodized hen laying ..	4 1	3 years	0·1380	0·007	0·505
2/4/30	Iodized hen just stopped laying ..	3 10	4 years	0·2655	0·0011	0·426
2/4/30	Iodized hen not laying	3 14½	5 years	0·2049	0·0004	0·212
2/4/30	Iodized hen not laying	4 10	5 years	0·2571	0·0004	0·147
2/4/30	Non-iodized hen ..	2 14	3 years	0·1766	0·0004	0·217
7/5/30	Non-iodized hen ..	3 11	3 years	0·2408	0·0004	0·154
2/4/30	Pullet from iodized egg	3 2	6 months	0·1140	0·0001	0·097
2/4/30	Pullet from iodized egg	2 12	6 months	0·0830	0·00006	0·067
2/4/30	Pullet from non-iodized egg	2 0	6 months	0·1197	0·0002	0·178
14/5/30	Pullet from non-iodized egg	2 15	6 months	0·1297	0·0002	0·138

Fowl thyroids in the United States have been shown to have an iodine content of from 0·105 to 0·38 per cent., and in Scotland from 0·14 to 0·21 per cent.

Quoting from the literature on this subject, the iodine content of eggs varies in Switzerland from 8 to 22 gammas per 100 grammes, in Germany from 5 to 33 gammas, in Scotland from 5 to 20 gammas, and in New Zealand from 6 to 14 gammas (Hercus and Roberts). Hercus and Roberts also found a distinct seasonal variation in the iodine content of eggs, the maximum being in the summer. Some eggs from Tai Tapu, Canterbury, gave on analysis the figures for iodine set out in Table 5 (next page). It will be noticed that the lowest iodine content occurs in April and May.

Table 5.

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.
	Grammes.	Gammas.	Gammas.
21/9/29	43·8	9	19
24/10/29	53·0	7	14
11/12/29	42·7	8	19
31/1/30	47·8	7	14
24/2/30	53·2	10	18
24/2/30	48·5	9	19
3/4/30	65·4	5	8
3/5/30	56·1	5	10
21/9/29*	47·6	7	14
21/9/29*	42·2	10	25

* Christchurch eggs.

General Remarks.

The peculiar point which emerges from the locally conducted iodine-feeding experiments is that the iodizing of the eggs did not have much effect on the iodine content of the thyroids of the pullets hatched from these eggs. They were the smallest thyroids and had the lowest iodine content of all. As previously mentioned, all the eggs from the iodized hens were fertile, and 85 per cent. were pullets.

These experiments confirm the fact that the iodine content of eggs may be increased by a very simple and cheap means, and this affords another method of feeding iodine to the human consumer—a method which may have distinct advantages over others.

CELLOPHANE PAPER AND WOOD-TAINT IN BUTTER.

An experiment was recently carried out at the Moturoa Grading Stores to ascertain whether Cellophane paper as a liner for Swedish timber butter-boxes could prevent contamination of the butter with the aroma of the wood. By courtesy of the Inglewood Co-operative Dairy Co., which use Swedish butter-boxes, four of the boxes were packed with butter from the same churning. Two boxes were lined with a wrapping consisting of Cellophane envelope and a wrapping of parchment-paper, and the other two boxes with the usual two wrappings of parchment-paper.

The butters were regraded after two months' cold storage, and all found to be wood-tainted on the surface. Had this defect not been present the quality of the butters would have stood up to the original grade score of 95 points. The butters were afterwards held for about a week at ordinary temperatures in the grading-room, and both the specially wrapped and control butters were surface-tainted to much the same extent.

It is therefore concluded that the use of Cellophane paper is of no practical value for the purpose indicated.

—*Dairy Division.*

PROSPECTING FOR PHOSPHATE ROCK.

PROCEDURE UNDER THE MINING ACT.

Mines Department.

THE statutory procedure to be followed to obtain a right to prospect for phosphate rock under the provisions of the Mining Act, 1926, depends to a large extent upon the date and nature of the title to or the ownership of the land upon or under which it is desired to prospect. The existing law governing such procedure is somewhat involved, and it is therefore prudent for a prospector to engage the services of a solicitor in all cases where he is satisfied that the mineral prospects are such as would justify the incurring of the legal expense necessary to obtain the grant of a mining privilege. However, as it is desired to place prospectors in a position to understand the matter (though without accepting any responsibility as to the effect) the following brief summary of the law is given :—

(1) The Crown has no jurisdiction over phosphate rock, or any other mineral, unless it is situated on Crown land, or on lands the mineral rights of which are reserved to the Crown.

(2) If the mineral is situated on private land, and the owner holds the mineral rights, no prospecting for or any action in connection therewith can be commenced without the consent of the owner and occupier.

(3) The first essential necessary to engage in prospecting operations is a miner's right, which will, upon application, be issued by any Warden or Mining Registrar, or by any duly authorized Postmaster. The fee payable is 5s. where the application does not relate to Native ceded land, but where it does so relate a fee of £1 is payable. The right continues in force for twelve months and is not transferable.

(4) A miner's right confers upon the holder the right (*a*) to prospect for any metal or mineral on Crown lands open for prospecting, excepting Native ceded land; or all such lands with the addition of any such one block of Native ceded land as is specified in the miner's right at the time of its issue; (*b*) to take up and hold *within a mining district*, without application to or license from the Warden, one ordinary alluvial claim for each miner's right. The area of an alluvial claim held under this condition is 10,000 square feet.

Under the definition in the Mining Act, 1926, "Crown lands" means all lands whatsoever the title whereto in fee-simple is vested in His Majesty, whether by virtue of his prerogative or by operation of law, or by any deed or instrument, whether such lands are unalienated or are alienated by way of lease or license for depasturing purposes, or as a small grazing-run, under any Act providing for the disposition of lands of the Crown; and includes Native ceded lands, and all other lands whatsoever over which His Majesty, or the Governor-General or the Minister on his behalf, by cession, agreement, or otherwise, possesses the right to authorize the carrying-on of mining operations; but except where otherwise specially provided in the Mining Act, 1926, does not include (*a*) lands held by His Majesty on any trust, express or implied, in favour of any person; nor (*b*) lands held by His Majesty but dedicated to any public purpose; nor (*c*) public reserves and endowments within the meaning of the Mining Act, 1926.

Lands open for prospecting include Native land which a Native Land Court has, upon application by or on behalf of the Governor-General, declared to be open for prospecting in terms of section 30 of the Mining Act, 1926.

All public reserves and all endowments, as previously stated, also Native reserves, are, with the following exception, exempt from the operation of the Mining Act, 1926: Provided that all such reserves and endowments and Native reserves which, on the coming into operation of that Act, were within the operation of any former Mining Act are to the same extent subject to the operation of the first-mentioned Act. The exception referred to relates to lands set apart for forest purposes or for scenic purposes, in both of which cases no rights can be issued without the consent of the Minister for the time being charged with the administration of the State Forests and Scenery-preservation Acts.

(**5**) As stated in paragraph (2), the Crown has no jurisdiction over private lands the owner of which holds the mineral rights. If the owner of the freehold is also the owner of the minerals the procedure to be followed is to obtain the consent of the owner and occupier (if any), and then apply to the nearest Warden's Court for any description of mining privilege authorized by the Mining Act in the case of Crown lands in a mining district.

(**6**) If it is desired to obtain a prospecting warrant or a prospecting license, the Governor-General, in respect of Native land, or the Warden in the case of other lands that are open for prospecting and which are situated in a mining district, may, in pursuance of section 70 of the Mining Act, 1926, grant such warrant or license respectively, subject to the applicant complying with the requirements of section 73, and also subject to the written consent of the owner and occupier of the land described in the foregoing paragraph (5). Attention is also called to Regulations 7 to 14, both inclusive, under the Mining Act, 1926, relating to such rights.

In the case of lands open for prospecting situated outside a mining district, other than Native lands, the Commissioner of Crown Lands may, subject to the consent of the Minister of Mines, and subject to the conditions already referred to, grant such warrant or license.

(**7**) The term of a prospecting warrant or prospecting license is one year. The holder has, however, the right in priority in respect of the land included in such warrant or license, provided (1) he gives notice in writing, not less than fourteen days before the expiry of his warrant or license, of his intention to apply for a new warrant or license; (2) the application is made not later than seven days after the expiry of the warrant or license, and the land comprised therein has within that period been identified or marked out as required in an application under paragraphs (*b*) or (*c*) of section 73; and (3) the applicant furnishes with his application full particulars in writing of the work done and money expended by him in prospecting operations during the preceding twelve months, and the Governor-General or Warden, as the case may be, is satisfied that the applicant has satisfactorily carried out the terms and conditions of the expired warrant or license. A fee of £1 is payable in repsect of a prospecting warrant, and a fee computed at the rate of 1s. for every acre of land, but being in no case less than £1, in respect of a prospecting license, both fees being payable in advance. The area is limited to 100 acres, but any number of warrants or licenses may be acquired by one person.

A prospecting warrant confers a non-exclusive right, and a prospecting license an exclusive right, to prospect on the land to which it relates.

The conditions to which the issue of prospecting warrants or licenses are subject, the provisions which apply in respect of the payment of compensation to the owner and occupier of land not being unalienated Crown land for damage done to such land, and a schedule of lands which are exempted from prospecting are contained in sections 74 to 76 of the Mining Act, 1926.

(**8**) With the consent in writing of the Minister of Mines, the Warden within a mining district, or the Commissioner of Crown Lands outside a mining district, may, pursuant to section 77 of the Mining Act, 1926, grant

to any person a mineral prospecting warrant authorizing the holder to prospect for any specified mineral or minerals over any Crown or other lands specified in the warrant, not exceeding 10,000 acres; provided that no such warrant will be issued with respect to any land other than Crown land unless the consent in writing of the owner and lessee (if any) of the land has been obtained and is deposited with the Warden or the Commissioner, as the case may be.

The term of such warrant is five years, and the holder has the exclusive right to prospect for the mineral or minerals specified in the warrant on the land to which the warrant relates. A deposit as security for compliance with the requirements of the Mining Act and regulations is required to be made by each applicant for a warrant, such deposit being £50 for the first 1,000 acres applied for, with an additional £25 for each 1,000 acres or fraction thereof in excess of 1,000 acres. The rental payable is 1d. an acre per annum for the first two years, 2d. for the third year, 3d. for the fourth year, and 6d. for the fifth year.

The provisions of the law relating to the labour to be employed on the area comprised by the warrant, the necessity to transmit six-monthly reports of prospecting and statements of expenditure, and the conditions governing the refund of the deposit, are contained in Regulations Nos. 18, 19, and 21 under the Mining Act, 1926.

(**9**) At any time while a mineral prospecting warrant is in force the holder, if he is satisfied that the mineral for which he is prospecting exists in payable quantities, has the right under section 81 of the Mining Act, 1926, to a mineral lease of such part of the land to which the warrant relates, not exceeding 1,000 acres and in one continuous block, as he may select. The term of a mineral lease is not to exceed sixty-three years.

A deposit, as security for compliance with the requirements of the Mining Act and regulations, must accompany each application, such deposit being at the rate of £1 for every acre of land applied for, but not exceeding in the whole a deposit of £1,000. A rental of 2s. 6d. an acre or part thereof per annum is payable under a mineral lease, and a royalty of one-twentieth of the value of the mineral at the pit's mouth, such value to be fixed before a lease is issued. Should the prescribed royalty exceed the amount of rent in any one year, then such rental ceases for that year. The regulations relating to mineral leases are Nos. 16 to 17 and 20 to 23.

(**10**) With the consent of the Minister of Mines the Warden may, pursuant to section 106 of the Mining Act, 1926, and subject to the provisions of that Act, grant mineral licenses authorizing the licensees to occupy any Crown land within or outside a mining district for the purpose of mining for any specified metal or mineral other than gold. The maximum area that may be held under a mineral license is 320 acres, and the term of the license may be for any number of years up to forty-two.

Rental is payable at the rate of 2s. 6d. an acre or part thereof, and in addition a royalty in respect of all the specified metals and minerals raised pursuant to the license, such royalty being not less than one-hundredth nor more than one twenty-fifth of their value at the pit's mouth.

Attention is directed to section 169 of the Mining Act, 1926, and Regulation 33 thereunder, in which is set forth the general procedure on applications to the Warden or Commissioner of Crown Lands in respect of mining privileges. Where a mining privilege is required by law to be marked out or surveyed attention is also called to Regulation 32 and Regulations 34 to 37, both inclusive.

Prospectors are recommended to acquaint themselves with the provisions of the Mining Act and the regulations relating to the acquisition of mining privileges. Copies of the Mining Act, 1926, and the regulations thereunder may be obtained from the Government Printer, Wellington, at 10s., plus 1s. for postage and registration.

TREE-PLANTING METHODS.

PRACTICAL GUIDANCE FOR SETTLERS.

Extract from State Forest Service Circular No. 19: "Tree-planting."

As methods of planting trees are governed by the class of soil, climatic conditions, magnitude of area, and the species and type of stock utilized, it is not possible to lay down a definite rule to be followed in all cases. It is hoped, however, that the description of the various methods adopted by the State Forest Service will prove of assistance to private planters and enable them to evolve a practice to meet individual requirements.

A settler who plants a few acres annually is usually able to devote more time and care towards preparatory cultivation, &c., than is possible in large-scale operations of commercial projects where economy of establishment has an important bearing on the ultimate financial success of the plantation, and consequently more satisfactory results should be attained from farm plantations.

Preparation of the Land.

The extent to which the land should be cleared prior to planting depends largely upon local climatic conditions and the existing weed-growth. In many localities it will be found desirable to leave the low-growing indigenous growth in order to afford protection to the young trees. In districts subject to unseasonable frosts its has been found preferable to burn off all growth which is likely to impede the free circulation of the air.

Generally it will be found advisable to remove in some measure the strong growth, such as manuka or very heavy bracken, if it tends to impede the work of planting or to shade excessively the young trees in their earlier years. Burning-off should be carried out some time previous to planting, which should be deferred until the land has been well soaked with rain.

Scrub or slash should be burnt off before commencing planting operations, as dead and dying timber is unsightly; in falling it tends to injure the young growth, increases the danger from fire, and invites and harbours many species of insects which may be injurious to young growth.

For small areas and wind-breaks where quick growth is specially desired it will be best to plough and cultivate the area to be planted; if the soil is very poor, a little manure, such as basic super, can be worked in during cultivation. Remarkably quick growths are often obtained under such favourable conditions, and the ploughed area can often be utilized during the first season for the growth of such crops as potatoes, &c., between the lines of trees.

Planting-distances.

Several factors govern the proper distances at which to space trees, individual requirements being to some extent the determining one. For example, single rows along fence-lines may be spaced in accordance with the planter's desire and object. In order to provide close

shelter a spacing-distance of from 12 ft. to 16 ft. will generally be found suitable. Intervals of 6 ft. to 8 ft. will more rapidly attain that objective, but the trees will not retain so many lower branches, although the ultimate timber produced will be of better quality. In practice, probably the most satisfactory method is to plant at 6 ft. to 8 ft., to achieve quick shelter; and then to remove every alternate tree whilst still in the sapling stage.

If the objective is the growth of merchantable timber the trees should be spaced 8 ft. apart each way, which is considered more economical and suitable for most conifers and eucalypts, and is adopted as the standard for the State plantations.

Owing to its strong branching habit, *Cupressus macrocarpa* when planted with the object of providing fencing-material and timber should, however, not be spaced more than 6 ft. apart each way.

The following table indicates the required number of trees at specified distances apart:—

Number of Trees required to plant an Acre of Ground, and also for Lines One Mile in Length.

Distance apart, in Feet.	Number required		Distance Apart, in Feet.	Number required	
	Per Acre.	Per Mile Length.		Per Acre.	Per Mile Length.
3	4,840	1,760	17	150	310
4	2,722	1,320	18	134	293
5	1,742	1,056	19	120	278
6	1,210	880	20	110	264
7	889	754	21	99	251
8	680	660	22	90	240
9	537	586	23	83	230
10	435	528	24	75	220
11	360	480	25	70	211
12	302	440	26	64	203
13	257	406	27	61	195
14	222	377	28	55	188
15	193	352	29	51	182
16	169	330	30	48	176

Time to Plant.

Generally speaking, in the North Island planting carried out before the end of May gives the best results, but for spring planting mid-August to the end of September is usually suitable.

In the South Island August and September are usually preferable, but in the northern portions of Canterbury and farther north some autumn planting can be done in May.

This applies in a general way to small-scale planting for farmers, local bodies, &c., and is intended to give optimum results only. On large-scale planting in many districts advantage may be taken of the whole late May - early October season for planting purposes. In some few districts early and dry spring weather makes autumn planting compulsory; in others a rigorous June and July enforces September planting to the exclusion of all other months. The choice of planting time in such exacting districts can only be made by close knowledge of local conditions.

Planting Methods.

(1) *Pitting.*—This method consists of the formation of holes or pits. In open pits the soil is taken out with the fourth cut of the spade and deposited alongside the hole, broken up, and replaced when planting the trees.

A modification of this system has been practised to a great extent in the State plantations, whereby the soil is turned over into the hole and chopped with spade. When planting takes place the spade is driven vertically into the loosened soil and the tree planted firmly in the slit. This is an excellent method when planting small areas and shelter-belts, and is eminently suitable for trees with a large root-system, or for species of a tender nature, such as macrocarpa.

(2) *Notching.*—Notching aims at cutting out the cost of pitting by planting the trees on land without any previous preparation except clearing. Where a heavy grass turf exists notch planting is not advisable without first cutting away the turf, as unless great care is exercised grass is pushed into the cut by the spade, which in dry weather tends to open the ground, admitting sun and wind to the roots of the tree. Under such conditions, pitting, grubber planting, or line ploughing should be adopted. Several methods of notching are practised, the crudest being that of simply inserting a spade into the soil and moving it backwards and forwards to make an opening, in which the tree is inserted. The weakness of this method is that the backward and forward movements of the spade make an opening the shape of an hour-glass, which it is not possible to eliminate, and tend to cause heavy losses through air-space at the bottom of the cut.

The difficulty may be eliminated by one of the following methods :—

(*a*) Make two spade-cuts in the soil, the second cut being at right angles to the first and joined at one end, thus forming two adjacent sides of a square in the form of the letter L. When making the second cut the handle is drawn backwards before the spade is removed, thus lifting up the soil in a roughly triangular piece, and leaving an opening in the angle formed by the two cuts, in which the tree is inserted. After the tree is placed in position the spade is withdrawn, and the tree firmed by tramping the sod hard back into position.

(*b*) Upright T : This method is successful in loose or crumbling soils. The tail of the T is made with the first cut and the top with the second. The back of the spade faces away from the planter, and is pressed slightly back to make a firm face on the top of the T. The handle of the spade is then drawn towards the planter, and the tree is placed in the opening thus left at the back of the spade, which is held in the ground meanwhile to prevent the loose soil filling the cut. When the tree is in position the spade is removed and the soil pressed back with the foot.

(*c*) Reclining T : *i.e.*, the first cut is across the line to be planted, and the second cut is made anywhere across the first, really forming a T on its side thus, ⊣ . The handle of the spade is drawn across the front of the body, the action levering up the two sides of the stem of the T. The tree is placed in the centre of the opening with a downward and then upward sweep. The downward sweep puts the roots well down, and the upward pull brings the tree in the right

position with the roots standing open and upright. When the spade is taken away the two sides fall, and, meeting on the stem of the tree, form a very effective jam, which is secured by two stamps of the heel, one on either side of the cut. This method is satisfactory in firm or stiff soils. If tried in loose soil the first cut does not open up cleanly. The method has the advantage of the spade-handle being out of the planter's way when the tree is being planted.

(*d*) In this method the first cut of the spade is made diagonally, the second cut vertically. After inserting the spade to its full depth (9 in.) the second time, the planter pushes the handle away from him, with the result that a wedge-shaped block of soil is pushed outwards. The tree is inserted against the vertical face, and the soil pushed back against it with the heel of the boot. This method is satisfactory on medium clay land and medium stony country with the aid of a triangular-shaped steel planting spade or spear.

A careful perusal of these descriptions will show—(i) That in each case the objective is to provide a vertical face against which the tree can be planted; (ii) that the opening must be made in such a way that *a proper firming of the soil is ensured and no air-spaces are left.*

Where the wind is a serious factor, the upright face of the opening should face to the prevailing wind.

(3) *Grubber Planting.*—On steep country and heavy grass-land grubber planting has proved to be entirely satisfactory, and almost as cheap as notching. The best tool for the purpose is a No. 2 ship-wright's or carpenter's adze, with a blade about 9 in. long. The grass or weeds should first be chipped off the planting-spot and the blade driven into the soil to full depth; next, with an upward movement wrench the soil up, withdraw the adze and drive in again in the same place as straight as possible, then pull the adze forward, and a planting-hole is thereby made about 9 in. deep. Place the tree in this opening, work in the soil with the adze, and *tramp firm.*

(4) *Line Ploughing.*—A planting-line is formed by means of a single-furrow plough. One light furrow is turned over, and the trees notched in with a spade or planting-tool in the bottom of the furrow. The method is simple, and is suitable on *flat* grassy country. The trees are sheltered, free of interference by grass-growth, but in order to retain the top soil the furrow turned over should be light.

Planting from Trays.

For such species as macrocarpa and some of the eucalypts, trayed or boxed trees are recommended in preference to open-rooted stock, which is difficult to transplant successfully.

Planting should be done in the following manner: The planting-pits should first be prepared, and the ends of the trays cut down with a tin-opener. At the actual time of planting, each tree, with about 1½ in. of soil and matted root attached, should be moved separately by cutting with a sheath-knife.

By following this plan of raising and handling the seedlings, with a little care the loss should not exceed 1 per cent., whereas if the open-rooted method is followed a large percentage of the young trees may not survive the first season.

Unpacking and Treatment of Trees not immediately required.

Trees are usually packed to arrive in good condition after a week or ten days' journey, but in cases where extraordinary delays occur and the plants arrive in bad order they should be treated as follows to harden them gradually to open-air conditions:—

Take the plants from the case and stand them upright in a shallow box. Open up the bundles to allow the air to circulate freely around the stem and leaves of each plant, and cover the roots with damp moss, straw, and soil. Leave them for about twenty-four hours in the shelter of a cool shed and away from direct sunlight. The trees should then be heeled-in or lined-out for a week or two, and for this purpose a well-worked, somewhat dry piece of ground should be selected, and on no account use damp, cold land. Space the plants in rows 1 ft. apart and from ½ in. to 1 in. between each plant. It is most important to tramp the soil firmly over the roots of such heeled-in plants. Loose soil holds air pockets which allow roots to dry out. Plants treated in this manner are much more likely to succeed than if taken direct from the packing-case and placed in their permanent positions.

It must be understood that this procedure is only necessary when plants are in bad condition on arrival. Slightly withered and droopy trees can generally be revived by *opening up bundles* and placing plants in a shady position, with roots buried in moist soil, for a few days.

Where trees are not required for immediate planting the bundles should be opened up and the seedlings heeled into a trench about 1 in. or so apart (more if the trees are large and bushy) and their roots covered with soil, fairly well firmed. (This heeling-in ground should not be in a wet and cold place.) By this method trees can be held for any reasonable length of time.

Plants supplied in trays, when not required for immediate planting, may be sunk flat into soil in a sheltered place, and if watering is necessary it should be done sparingly.

Summary.

The advantages and disadvantages of various methods may be thus summarized:—

Pitting:—

(1) An inexperienced or careless planter is less likely to get the roots into the ground straight. Open pits are especially good in heavy clay land, and are essential in excessively stony soil.
(2) An open pit or the prepared spot induces a quicker start being made by the tree.
(3) Rows of trees are more easily distinguished if blanks have to be replaced.

Notching:—

(4) Notching reduces the cost per acre by from 15s. to £1.
(5) Trees planted by notching may not grow as rapidly for the first year as in prepared soil.
(6) There is no appreciable difference in the death-rate of trees planted by the different methods.

(7) The effects of heavy frosts are less than where the ground is disturbed more, as in pitting.

Whichever method is adopted the human factor is always present. There is a right and a wrong way to plant a tree, and to get results the planter must be sufficiently interested in his work to be determined upon success.

The following general rules should be observed in order to obtain success :—

(1) Plant the tree no deeper than it was growing when in the nursery.

(2) Place the tree in the centre of the pit, so as to allow the roots an even chance all round. In very exposed places the plant should be placed against the solid earth on the side of the pit facing the prevailing wind.

(3) Plant the tree in an upright position, with tap-root going straight down and lateral roots spread out and not bunched together or bent.

(4) Never allow the roots to become dry, or even apparently dry.

(5) Work the soil first gently in about the roots, *then firm it well by tramping the surface.*

(6) Care must be exercised to avoid damaging or barking the stem when firming the soil round the planted tree.

CASTRATION OF PIGS AND CALVES.

PRECAUTIONS AGAINST SCROTAL ABSCESSES.

J. E. McIlwaine, M.R.C.V.S., Animal Husbandry Section, Live-stock Division.

A somewhat prevalent defect in dressed pig carcasses, as noticed at the various works, is the presence of abscesses in the scrotal region at the seat of castration, apparently the result of infection gaining entrance at the time of the operation. If the general grading of pork is introduced, as called for by the recent conference at Palmerston North, such abscesses may debar carcasses from export. The extra dissection required to remove the abscesses is liable to injure the hind quarters, especially involving the valuable cuts.

It is usual to carry out the operation of castration when the young pigs are about three or four weeks old. Occasionally it may be necessary to castrate an older animal, but farmers would be well advised to make it a practice of castrating at an early age. The actual requirements for the operation need not necessarily comprise any elaborate outfit, but emphasis must be laid on the necessity for cleanliness. Thorough cleanliness of the hands, the operating-knives, and the quarters occupied by the pigs both before and after the operation is essential to prevent sepsis and abscess formation. Cleanliness as applied to the operating-knife means sterilizing by boiling for a few minutes. The blade may be wrapped in cotton-wool during boiling. Cleanliness in the quarters means a clean bed of fresh straw, or if the pigs are in the open a fresh green paddock with a good sole of grass. The hands should be scrubbed and attention paid to the finger-nails, as the nails often come in actual contact with the wound during the removal of the testicle.

The following is a procedure which should give good results, provided the foregoing precautions are taken. The knife is already prepared, and it is also desirable to have a bucket containing a weak solution of a reliable antiseptic at hand. When not in use the knife should be returned to the bucket of antiseptic and left there till again required. An assistant seizes the pig by one of the hind legs and carries it to the operator. It is usual to fix the pig with the nose under one arm (squealing may be thus controlled), and the assistant, holding a hind leg in each hand and seated, exposes the site of operation. The operator paints the site with tincture of iodine, or, if much dirt is present, swabs the site with an antiseptic solution contained in a separate vessel from that holding the knife. One testicle is isolated between the fingers and thumb of the left hand, the skin is firmly held over the testicle, and an incision made from one end to the other, when the testicle is exposed. With such young animals it is usual to scrape the cord for detaching the testicle. The risk of hæmorrhage is very slight. The same procedure is adopted with the other testicle, and before the animal is released in its clean surroundings the wounds are flushed by pouring some antiseptic into them. This is obtained from the vessel used to contain the knife. The knife may be returned to this vessel until another pig is procured for the operation. Probably a common cause of abscess-formation is the fact that the incision in many cases is too small, and does not allow proper drainage at the lowest point afterwards. Thorough cleanliness should be observed by the operator throughout.

The Burdizzo instrument is not suitable for the castration of pigs, the scrotum being too closely attached to the body.

In the case of calves castration is usually carried out at the age of from two to three months. An assistant is required to control the calf, whether the animal is cast or whether the operation is carried out with the calf in the standing position. It is not necessary to use any special means of control, provided the calf is firmly held against a fence or something equivalent. The procedure is similar to that described for pigs, and scraping the cord is the usual method of detaching the testicle. The cord may be severed by an emasculator, but this instrument is not necessary for such young animals. It is advisable, however, to use it when older calves or pigs are being operated upon. The method in which two incisions are made, instead of removing the end of the scrotal sac, aims at leaving a better "cod," as expressed in butchers' terms.

In conclusion, it is advisable for a beginner contemplating the performance of this operation to obtain a demonstration from an experienced operator. The time required to operate with care and cleanliness does not exceed that required by careless work, and the results are much more satisfactory. The correct method is worth acquiring from the first, and details must be attended to if an all-round improvement on the lines indicated is to be attained.

"Ante-natal Deformity of Lambs": Correction.—Referring to the paragraph on iodine deficiency in this article as published in last month's *Journal* (page 296), the analyses of thyroids were inadvertently stated as both made from fœtuses. Analysis No. 2 was from the thyroid of a ewe which produced a deformed fœtus.

SEASONAL NOTES.

THE FARM.

The Pastures.

EXTENSIVE experience has taught that pasture top-dressing may be carried out with good results during July where it has not been done earlier. If from such top-dressing it is desirable, as it usually is, to secure growth as quickly as possible, then ordinarily superphosphate should be used. Even on relatively cold soils super applied in July has been found to produce substantial increases in the amount of feed available in August. It is not to be inferred from this that July is the month which should be selected for the application of super; previously in these notes the application of super and of other phosphates to grassland much earlier in the season has been recommended. Now the matter is mentioned again because if the top-dressing for some reason or other has not yet been done it may still be carried out with profitable results.

Under normal conditions the application of sulphate of ammonia about mid-July to suitable grass-paddocks may be counted upon to result in a material increase in the feed available from the dressed paddocks during August and September. For a few weeks prior to the middle of July it is probably well not to apply sulphate of ammonia; it appears not to act at this period when plants tend to be most dormant in their growth, and its fertilizing influence is apt to be more or less wasted. Fields to which sulphate of ammonia is to be applied should be grazed down evenly and closely, and thoroughly harrowed prior to the application. As a general rule super should be used in conjunction with sulphate of ammonia. As an emergency means of increasing the early-season grass-growth when there is a prospect of scant supplies of feed the use of sulphate of ammonia on grassland promises to be successful, especially if the pasture to which it is applied contains a considerable proportion of rye-grass. Sulphate of ammonia may suitably be mixed with superphosphate prior to application, but the mixing of it thus with basic slag should be avoided because of the undesirable chemical action which would result.

Harrowing of pastures during July is work which calls for attention if it has not already been carried out. It is particularly necessary on fields which have been stocked heavily during May and June. Harrowing is of great value as a means of breaking up and distributing animal-droppings, and when this latter work calls for attention a section of chain harrow should be attached behind the portion used for its cultivating effect. Harrowing should be valued as a means of carrying out cultivation—cultivation which will aerate the soil, foster the development of feeding-roots in the better pasture plants, and tear out rubbishy matted growth. Such work done by harrows is analogous in its influence to the hoof cultivation that results from the trampling of stock, and that is of proven great value provided it is not overdone.

Suitable paddocks, preferably well-drained ones, provided with shelter and with herbage in which rye-grass is prominent, should often be closed up during July for the use later on of early-calving cows or early-lambing ewes. On such paddocks the rye-grass is of particular value because of its early growth under conditions of reasonably good drainage.

To avoid damage by poaching of the soil, paddocks which have become wet and soft should be used as little as possible. On such paddocks injury the influence of which persists permanently may be done if care is not taken to minimize poaching. Greatest damage is liable to occur by

neglect in this connection of recently-sown-down paddocks. Two rules that may be followed to prevent avoidable poaching are—firstly, if possible do not stock low-lying paddocks; and, secondly, feed out hay and roots on the higher, drier portions of the farm that often are also the poorer portions, the fertility of which will be usefully increased by such feeding.

Drainage in Grass-farming.

The value of good drainage in the production of annual and other special crops, such as lucerne, is unquestioned, but some are inclined to attribute less value to it on farms which depend largely upon grass. The true position is that adequate drainage has an important bearing on grass-land farming, for the following reasons :—

(*a*) It begets warmer soil conditions in the spring, which favour earlier growth of all the common pasture species, and so it provides greater growth at a critical time.

(*b*) It begets greater total annual growth, because it favours the more productive pasture species such as rye-grass and clovers.

(*c*) It results in greater returns from the use of suitable fertilizers and high-class seed.

(*d*) Because of its beneficial influence on the health and general thrift of stock it begets more efficient pasture utilization. Among the disorders which are lessened by good drainage are such serious ones as mammitis, foot-rot, tuberculosis, fluke, calving troubles, and parasitic worms.

Drainage is to be looked upon as an auxiliary rather than as an alternative to top-dressing.

On much of our poorly drained land mole drainage would unquestionably prove so effective and lasting in its influence as to be markedly profitable. This has been proved in actual practice by both sheep-farmers and dairy-farmers on this type of land. All the work attached to providing mole drains 9 ft. apart and 18 in. deep will be done by contractors at a charge of from £1 5s. to £1 7s. 6d. per acre, while a farmer using his own tractor will normally be able to do the work at a substantially lower cost, after having allowed adequately for interest, depreciation, material, and labour. Over extensive areas mole drains at a depth of from 14 in. to 16 in. serve excellently.

This is the recognized time of the year for giving attention to drainage. Apart from the actual work of constructing new drains, there are other important matters which frequently call for attention. Open drains, for instance, should be kept clear.

Mole- and tile-drain lines and outlets should be inspected after heavy rains in order to detect and locate any trouble in the working of the drains. All indications of want of drainage should be noted. Knowledge of such indications often is of value when any comprehensive drainage-work is being undertaken. Every opportunity should be taken to study the natural fall of the farm. Sometimes much drainage-work is rendered ineffective or unduly costly because the natural fall of the land is not properly understood when the work is being started. For instance, the running of mole drains across saucer-shaped depressions is likely to give trouble eventually even though the drains function for some time at least. It could usually be avoided by a complete knowledge of the lie of the land. Again, it is not advisable that the fall of a drain become less as the outlet is approached. Yet, because the general fall was not fully considered in the beginning, this is sometimes allowed to happen.

In carrying out mole drainage the natural slope of the land needs to be considered carefully, for if mole drains have too much fall they will scour in an undesirable manner.

Finally, emphasis may fittingly be placed on the need in drainage for sound planning and thorough work right from the start; if weakness creeps in it frequently is not easy to locate and almost always is costly to

rectify. The fact that the greater part of a drainage system is invisible makes it relatively difficult to estimate whether the system is acting as efficiently as it naturally should. From all this it follows that care, thought, and thoroughness should characterize drainage-work throughout.

It does not follow that because land is poorly drained it should not receive dressings of fertilizer. Indeed, in certain circumstances top-dressing of poorly drained land is definitely advisable. This arises from the fact that high fertility is requisite for success with such species as meadow foxtail, Poa trivialis, and timothy, species valuable for conditions so wet that rye-grass and cocksfoot would not tolerate them. At times top-dressing by raising the fertility to meet the needs of these species will prove distinctly profitable. Apart from such special cases, top-dressing of poorly drained land is frequently profitable, although it would probably be more profitable with better drainage.

At times it may not be practicable to provide thorough under-drainage. When this is so it is well to remember that surface drainage, which can sometimes be arranged relatively easily, is much superior to no drainage.

Some Aspects of the Liming Position.

In New Zealand liming grassland has produced very varying results. In some instances field results make liming appear an absolute necessity, while in other cases, which are probably more frequent, carefully obtained field evidence does not support the contention that liming is a desirable or a profitable proposition. Such widely differing results are only to be expected when one takes into consideration not only the greatly differing types of soil, but also the differing pastures and climates with which our farming deals.

Further, the position is complicated by the fact that it does not follow there is no influence of lime because there is no visible influence. It is held by many, including recognized authorities, that the benefits of lime are not easily detected directly. For instance, Professor Stapledon, Director of the Empire grassland research, says: "It is only occasionally and in very bad cases that liming actually adds to the bulk or weight of grass per acre, but it very frequently has a considerable influence on quality." This being so, it is unsafe to condemn liming because of absence of visible evidence of its influence.

Since it is not easy to judge directly whether liming is profitable or not the farming community would welcome some ready reliable means of finding out when liming would be justified. Various attempts have been made to meet the widely felt want in this connection. These attempts usually involve the use of what are termed "lime-requirement" or "soil-acidity" tests. There is in the minds of some the impression that certain of these tests will quickly disclose the amount of lime that may be applied to a soil with profit. This is not so. Probably the best statement on this point is that of Sir John Russell, the present Director of the Imperial Soil Bureau. He says: "Before any indication can be given of the amount of lime required for cultivation, it is necessary to make field trials." This statement completely disposes of the alleged claims of quick and easy tests.

Another important point is that circumstances are conceivable in which the use of lime would be beneficial and profitable but yet not desirable. This position would arise when the possible expenditure on a farm is strictly limited. In such circumstances the question may arise whether it is better to spend money on lime or on phosphates. The answer to be given would depend not on whether lime proves profitable, but on whether it proves more profitable than phosphates. A general indication of what form the answer would take in such a case may be gained from the fact that over this country as a whole the weakest link in the soil supply of

plant-nutriment is the content of phosphates. Hence, usually the step that should be taken first is one that will build up the soil in phosphates.

When the use of lime will involve considerable outlay in cost of cartage or other transport, then it is important to bear in mind that 10 cwt. of burnt lime is equivalent in its influence on the soil to approximately 18 cwt. of ground limestone (carbonate of lime). Field trials indicate that when the two forms of lime are applied in the proportions of 10 to 18 the results obtained are equivalent.

Guidance of some value in regard to the necessity of liming is provided by the following rule: If phosphates are definitely producing good results, then probably liming does not call for attention; but if the soil does not respond profitably to phosphates, then the lime factor is probably the weak link in the chain of factors giving fertility. There may be exceptions to this rule; the soil supply of available potash or of nitrogen may be the weak link, in which case it will be economically sound to apply, before liming is attended to, fertilizers supplying potash or nitrogen. But the exceptions to the rule are much less frequent than many believe.

Another practical aspect of the lime position is expressed by stating that if the funds available for expenditure on soil-improvement are strictly limited, then rectifying the phosphate position should be the first consideration; when this has been done liming may be given attention.

In general, relatively frequent small dressings of lime give better results over a number of years than would an equal amount of lime applied in one comparatively heavy initial dressing.

Stock-feeding in the July Period.

July is often a critical month in respect to stock-feeding, and particularly so in the case of pregnant ewes and cows. With these, scanty July feeding should be avoided if it is at all possible. Several of the recommendations in last month's notes on crop utilization are applicable during July. After the swede crop has been consumed carrots should be fed if available, mangels, having the best keeping-qualities, being reserved for the final root feeding of the season. Chou moellier, which is generally in good condition for feeding in July, should be utilized then, for at times in August it is inclined to bolt to flowering-heads. Autumn-sown cereals should be fed before the growth becomes too long; in general, two light feedings of short growth are more satisfactory and involve less waste than one feeding of heavy growth. Catch-crops that are to be used for green-manuring should be ploughed down during the coming month.

Tillage for Arable Crops.

July should in general be looked upon as a month in which to avoid the sowing of seed. Hence if land which is being prepared for wheat cannot be sown by about mid-June the sowing may well be held over until August, unless there is some special circumstance which calls for sowing at an unfavourable period, such as a sure glut of work later on which it will prove impossible to handle properly. What applies to wheat applies equally to the sowing of other cereals at this season.

Often during July the soil contains so much moisture that tillage work may readily be more injurious than beneficial. This is particularly true of heavy types of soil. If soil freely clings to boots or implements that have passed over a field, then generally it will be well to postpone cultivation of that field. Ploughing of grassland should cease when the soil is so wet that furrows are produced with a glazed-looking surface.

Except when soils are too wet, however, cultivation work should be proceeded with as speedily as possible. Wheat, oats, and peas are crops which often can profitably be sown early in August if the land has been suitably prepared for them.

—R. P. Connell, M.A., Fields Division, Palmerston North.

THE ORCHARD.

Pruning.

Apples.—The longer economic life of the fruit-producing parts in apple-trees allows of greater elasticity in pruning, and almost every orchardist has his own particular variations, all of which in the aggregate arrive at about the same point from a weight-per-acre viewpoint. The systematist carries a mental picture of the tree during the last fruiting-season, and from that aims to eliminate the undesirable features and build towards his conception of the ideal tree. The basic principles of pruning are dictated by the tree, and the pruner's efforts should be more in the direction of assisting than correcting nature if a continued battle between the tree and the pruner is to be avoided.

Soil-conditions play an important part in determining just how much wood may be left to carry fruit-spurs, for it is obvious that a tree which is having a hard struggle to find sufficient nutriment to maintain wood-production must be treated differently to one which is running riot after each pruning, indicating that it desires some other outlet for its abundant energy. It is not uncommon to hear that notwithstanding regular pruning some trees refuse to produce fruit, and, excluding varieties such as Northern Spy, which are slow coming into bearing, in most instances it will be found that all the thin laterals have been cut out because they did not look strong and the strong shoots cut back to the base because they threatened to get out of reach, with the result that being shorn of its outlet for energy and to preserve the balance between root and top the tree produces fresh wood and fruit-production suffers.

A good example of the inclination of the tree is obtained from one which has been left unpruned for a season. It will be observed that in the first season strong clean shoots were made. In the second season many of these growths will flower at the tip and fruit-spurs will be formed at some of the eyes near the terminal extremity. On lateral bearers the spur-formation may occur during the first season. Following the spur-production fruit is carried and the wood-production decreases, and without sufficient stimulus, either in the form of pruning, manuring, or thinning, the tree will enter into a decline and eventually become an economic loss.

From this it will be seen that a certain amount of wood must be removed, and at this point the various systems and their modifications come into play. For the home orchardist a system of yearly extension and reasonable cropping offers fewest difficulties, and the more or less highly involved systems are best left to the professional grower who has his trees under constant observation and who can quickly resort to any corrective measures.

In every tree a varying number of main limbs or leaders are developed and terminally extended each year. Secondary shoots or laterals are added each season, and on these the bulk of the crop is carried. As the tree extends upward and outward more space becomes available and the leaders may be duplicated, but frequent duplication is not desirable, as there is a danger of the leaders loosing their identity, and the difficulties of pruning are greatly increased. Immediately below the point of last season's cut two or more shoots will have developed. Of these one must be selected to continue the lead, and is headed, removing about two-thirds of its length. During the next growing-season the uppermost eyes break into growth, and if too much wood was left the eyes on the lower portion will remain dormant and in time the limb will be a succession of fruitful and bare lengths. To eliminate the bare places the heading is regulated in that only sufficient is left to allow for the usual break and spur production peculiar to the variety. If the shortening is too drastic each eye is forced into

vigorous growth and fruit-production prevented. With the laterals, strong ones on the inside of the leader will be removed at the base, as also will any which challenge the leader for supremacy. This will result in the production of one or two weaker shoots at the point of removal. The light laterals are left uncut the first season and the older spurred twigs thinned or shortened as desired. Varieties which carry the bulk of their crop on the tips of the shoots require treatment which will permit the tree to follow its natural inclinations, for shortening the shoots removes an appreciable portion of the succeeding year's crop.

Jonathan represents a type which requires more severe treatment in order to frequently renew the fruiting-wood and maintain the necessary vegetative vigour. Here it is preferable to work rather on the severe side in heading; all laterals may be shortened, and each season some of the older, partially exhausted fruiting-shoots removed, or if possible cut back to a weak shoot which is also headed, in order to stimulate growth beyond the fruit. This variety's fruitful habit and weak growth calls for careful treatment if a sturdy tree is to be developed. Opportunity should be taken to shorten every limb with a drooping tendency to an upright growth, and pruning to inside eyes is often advisable.

Citrus Culture.

Picking will be the most constant operation during the coming month. The usual heavy demand for lemons at this season is sufficient inducement to watch the crop very closely and gather everything that shows a tinge of yellow. It is often difficult to avoid gathering damp fruit, but the practice is not wise, and only dry fruit should be stored for keeping. The presence of moisture assists in the spread of fungal growth, and cases should be stacked to allow of free circulation of air and frequent inspection. Draughty stores are to be avoided, and a fairly warm room hastens the process of wilting prior to dipping. The slight wilt is important, as immersion of the turgid fruit in the hot bath is liable to rupture the oil-cells in the rind and induce decay.

Cottony cushion scale sometimes becomes active during the winter months and very early in the spring. Any colonies should be cleaned up without delay and trees showing *Capnodium* should be rigidly inspected. Citrus brown-rot may be expected during wet weather, and it is unwise to await its appearance before spraying with bordeaux.

Attention to drainage is vitally important to the citrus-grove, and the opening of temporary drains for the rapid removal of water becomes a routine matter. Of almost equal importance while the time is opportune is the topping or trimming of shelter belts or hedges which overhang or are higher than is necessary.

—G. H. McIndoe, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

Feeding the Breeders.

A CORRESPONDENT has asked for advice in regard to feeding his prospective breeding-hens. He states that they are the pick of the late moulters which have produced heavily throughout the year, and he would like to know how to feed them in order that they may resume laying and their eggs may be available for the production of early-hatched chicks. The addition of such forcing food to the ration as meat, meat-meal, milk, &c., will tend to promote early laying, but I could not advise the adoption of this course. Obviously a bird which has just come through a heavy and forced laying-season, followed by the bodily strain entailed by the moulting

process, must necessarily be in a more or less exhausted condition, requiring a rest. It will not be in that vigorous condition necessary to produce eggs having a strong germ—the seed of good constitutional stock.

In selecting the breeding-hen it is not so much the egg-yielding capacity that should be studied as the power to transmit desirable qualities, and if a bird is not in the best of condition she will not be able to impress these qualities upon her offspring. It is certainly true that if a hen proves to be a persistent long-season layer she must possess a good constitution but where eggs for reproduction purposes are required it would be much wiser were she given an opportunity of regaining her strength by plain feeding, instead of forcing the time of production by means of a rich diet.

The Laying Type.

It is now quite an established fact that there is a laying type of fowl, and just as there is a desirable type of table bird, so there is also a type indicating by general appearance egg-laying capacity. As there are exceptions to every rule it sometimes happens that a bird of rather a different build to that looked for will prove to be highly profitable. This does not prove that the laying-type theory is not correct, but rather that our knowledge of it is not as extensive as it should be, particularly when applied from a breeding standpoint.

Many who are now realizing the value of a particular type as indicating laying-power are naturally with that enthusiasm common to progressive poultrymen—looking for anything which will guide them in their search for knowledge on this subject. It may be that they happen on photographs of birds published to illustrate type and the exceptions mentioned. I would urge poultry-keepers not to place too much reliance on such photographs, for probably there is no domestic bird or animal which when photographed illustrates its true type less than the fowl. It is common for a photographer to wait patiently for hours to secure a good picture of a high-type layer, and then not succeed. On one occasion I tried to obtain a faithful picture of a champion layer, and the three photos secured were so different one from the other that any one unacquainted with the facts would have refused to believe they were of the same bird. Sometimes it is possible to picture a bird by means of the camera just as it should appear, but more often than not a photo of a fowl gives a flat contradiction to the saying that the camera cannot lie. It is therefore well not to attach too much importance to photographic reproductions in judging type.

In regard to laying type the main point to be considered is the securing of breeders, and the fact that a freak type bird may prove to be a good layer is no guarantee that its descendants will be equally good layers. If used for breeding purposes the progeny of such a bird will probably be of all shapes and sizes, with nothing to distinguish them for production capacity. The aim of all successful breeders, no matter what the class of stock, is to develop if possible a uniform type of animal in flocks or herds from which they are breeding. Type is the first essential, and uniformity in that type is the next consideration.

With fancy poultry—that is, any breed conforming to approved fancy standards—it is easy enough for the breeder to judge the quality of a bird; but with utility poultry, when egg-production is the chief consideration, it is difficult for any one to judge the quality unless there is a standard laying type from which to work. Very much importance attaches to the question of a utility standard. It is not every one who has a natural eye for form, and even men who have had long and successful experience with utility poultry quite often fail in picking out the laying type; whereas with a definite recognized standard with points apportioned for each desired quality it is possible to attain fair success after patient study and sufficient experience. It must be admitted, however, that no matter how perfect

the system adopted (and the most satisfactory method is by awarding points for essential qualities) the judging of fowls is more or less a natural gift. In setting the desired standard the man who has a natural eye for the laying type can indicate how his judgment has been arrived at.

The Impending Hatching-period.

Where a good egg-yield is desired during the late autumn and early winter months (which should be the case on all plants if a maximum profit is to be made) the chickens which are to produce these should be hatched out by the end of July or early in August. The poultry-keeper who has neglected to have everything in good order preparatory to this important period will now suffer the results of his neglect. While it is never advisable to breed from pullets if hens can be obtained, the fact remains that on most plants there will be insufficient adult birds in the necessary productive condition to enable a desired number of chicks to be hatched out at this period of the year. Hence breeding from pullets must be resorted to. Where it is necessary to use pullets they should be well-matured birds hatched in the early spring, and be the progeny of hens, not pullets. It is far better to delay hatching operations than to breed from late-hatched or poorly-developed pullets.

Where the natural mother is depended upon the drawback to timely hatching is becoming more acute each year, owing to the difficulty of securing broody hens when required. As the laying type develops the broody tendency weakens, so that the more profitable the stock from an egg-laying point of view the greater will be the difficulty in obtaining broody hens. The most popular bird at the present time is the White Leghorn, and with the best-laying types of this breed broodiness has almost disappeared. Where the plant is a small one and an incubator is not used the difficulty is a serious one. There are two alternatives—either to have eggs artifically hatched by persons who have the necessary plant, or, better still, to secure stock as day-old chicks from a breeder of repute.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Winter Work.

SPARE supers that were left on the hives should now be removed—where it can be done without unduly disturbing the cluster—and the bees confined to the brood-chamber. In the northern parts of the Dominion breeding will start in colonies of normal strength at the latter end of July, and every effort should be made to make the bees snug so as to promote breeding. Where the bees have taken to the supers entirely the bottom story is the one to be removed.

During the dormant season mice are likely to make themselves troublesome in the apiary. They attack the stores, and otherwise destroy the combs. Many colonies are by this means reduced to the verge of starvation by the spring. It is the work of only a few minutes to examine the hives, and where gable roofs are adopted the mice-nests will usually be found on top of the mats. To obviate this trouble the entrance should be contracted.

Control of Wax-moth Pest.

In districts where wax-moths are troublesome, particularly the large one (*Galleria mellonella*), a periodical examination should be made of all extracting combs. These moths do an enormous amount of damage, particularly in the off season, and especially in districts where mild weather

conditions prevail. The moths not only attack the dry combs, but also combs of honey stored for spring feed.

Where the moth is prevalent in large numbers a special comb-room is essential, constructed so as to be nearly airtight and filled with racks on which to suspend the combs to enable fumigants to penetrate the cells. Where only a few combs have to be dealt with these may be stacked in supers, spaced eight to the super, care being exercised to see that the junctions of the boxes are made smoketight by pasting a strip of paper round them. The top box of the pile should contain no frames. Into this place an iron saucepan containing wood embers, and on these throw a small quantity of sulphur. Close the supers securely, and keep closed for a couple of days. In three weeks to a month a second fumigation should be given.

Bisulphide of carbon may be used to accomplish a similar result. In using this chemical the combs can be stacked in a tight box or supers. If the latter are used all cracks require to be closed with paper pasted on the outsides to prevent the fumes from escaping. Place a quantity of the bisulphide in an open dish on top of the combs. The liquid evaporates and the fumes, being heavier than air, settle over the combs, thus effectively killing the moths. This operation may have to be repeated during the winter months. Great care must be exercised when using the bisulphide, as it is highly explosive and dangerous, and on no account must a fire or light be allowed near the liquid when being used.

During the past two seasons Cyanogas (calcium cyanide) has been very successfully used in destroying bees by Apiary Instructors whose duties have called for the destruction of diseased colonies preparatory to burning. The active agent of calcium cyanide is liberated in the form of hydrocyanic-acid gas, which is a most deadly poison to all life. However, it can be used with safety because the liberation from the powder of the gas is slow, thus allowing the operator to retire after giving a charge. Fumigation of combs may be done in supers, after taking the precaution of making them gas-tight, in the same way as when using sulphur or bisulphide. In the event of a comb-room being used the supers containing the combs can be stacked criss-cross or placed on the racks usually provided. No other preparation is necessary. In operation the calcium-cyanide powder should be sprinkled on paper and placed under the tiers of supers or here and there about the buildings. For super-fumigation it is recommended to use a dose of 4 lb. to 100 cubic ft. of space. Half the quantity will suffice for airtight comb-rooms. These dosages will kill the moths in all stages. As already indicated, the gas, being deadly to all life, must be handled with great care. The writer has used calcium cyanide in the open air for killing bees and has watched its deadly results. Caution, however, is necessary when the chemical is used in buildings. The operator should leave the building as soon as possible, and lock the doors and windows. Twenty-four hours' treatment will suffice, after which the door of the room should be opened to allow the gas to escape, the building not being entered for from two to three hours.

Plans for next Season.

The off season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are in urgent need of room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and study, while the bees

are in a dormant condition, the best methods of improving his stocks. Neither weather conditions nor locality nor any other factor will influence the honey-crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Diseases and Pests of Small-fruits.

PLANTATIONS of this class are frequently found infested with diseases and pests. To control such attacks and improve the crops demands careful study now and energetic action in the very near future. Many specimens are received of raspberry-cane infected with rose-scale, wilt disease, leaf-spot, bud-moth, and anthracnose; also currants, gooseberries, strawberries, and loganberries with some of the same or similar troubles. Good crops of a fine sample may only be grown where an understanding interest is taken in these fungous and insect parasites, in addition to good cultural treatment, as was suggested in last month's notes.

The best time to attack these troubles is in summer-time as soon as the crop is gathered. Raspberry and loganberry canes should then be cut off at the surface of the ground and carried out and burnt, thus disposing of what is generally a large mass of material that is more or less infected. To leave stubs 3 in. to 4 in. long at this pruning is a mistake, as such portions are usually in the worst condition of any part of the old canes. With the removal of these old canes and young weak canes that are unprofitable the remaining growth is exposed to the air and sun to ripen, and may be easily given at once a series of effective chemical sprays to clean them up or prevent the attack of disease. Strawberry-beds may then have the old infected foliage mown off and burnt. The new autumn growth may afterwards be sprayed to destroy the spores of leaf-spot and brown-rot. The performance of summer pruning of currants and gooseberries provides similar opportunities for effective autumn spraying.

Where this treatment has been given in a thorough manner and the bushes have been properly winter-pruned and well manured, the prospects of a good crop should be very bright. However, as the bushes and plants commence to make new growth in the spring they should be given suitable spray treatment and carefully examined occasionally and any new developments noted. Where the summer treatment has been omitted the spray treatment now and on until fruiting-time will be the more urgent. Most of the fungus diseases may be controlled by applying bordeaux 4–4–40 as soon as growth commences, and repeating it, as may be necessary, at intervals of about two to three weeks. For the control of bud-moth of raspberries and loganberries arsenate-of-lead powder, 1 oz. to 4 gallons (¾ lb. to 50 gallons), should be added, first working it up with a little water into a cream before adding it to the bulk of the spray. This little caterpillar spends the summer feeding on the "receptacle" of the fruit, where he does little damage, but after hibernating in the ground he emerges in spring to climb the canes and burrow into the buds. The damage thus caused is sometimes extensive, and may be avoided by a timely application of arsenate.

The very common borer of black currants and gooseberries is at this season hibernating, and does not emerge until midsummer, when it does so in the form of a moth. Arsenate sprays would then be beneficial, but for the present the only check available is to cut out the old wood and burn it with the larvæ it contains.

The rose-scale, so common on raspberry-canes, is most effectively controlled by cutting low and burning the old wood in summer, thus reducing the autumn brood. In spring-time as soon as the young insects appear they may be readily destroyed by spraying with a good contact insecticide such as Black Leaf 40, using 1 part to 1,200 parts of water (1 pint to 150 gallons). It is very important to first dissolve 3 lb. to 4 lb. of good soap to the 100 gallons of water before adding the nicotine.

The Indoor Tomato Crop.

Tomato-plants now being raised for glasshouse planting should be well aired at all suitable opportunities. To rush them up big and soft gives a false appearance of vigour, and when planted out they are an easy prey to a cold snap. This plant demands a dry buoyant atmosphere, and this should be given whenever possible without chilling them. The plants are then perhaps not quite so big, but well rooted and hardy — a condition most favourable for resisting unavoidable low temperatures or any other troubles they may have to meet.

The soil under glass is sometimes allowed to become " bone dry " during the winter, and plants are sometimes planted out with the soil in such a state or nearly so. This is a serious mistake. In such a case—in fact, generally—the land should be thoroughly irrigated some time before planting takes place, so that all stickiness may disappear before that operation. If the plants are then firmly set in open furrows they may easily be given the little further watering required before the weather warms. When planting this or any other crop carefully scrutinize every plant and reject every one that is weak, diseased, or abnormal in any respect. It is only in this way that a strong even crop may be grown.

The Market-garden.

The cost of manures and the scarcity of those of an organic nature demand careful consideration if they are to be used with economy and best effect. It is not uncommon to find them used to excess; heavy green crops or dressings of stable manure are turned in annually, and the soil becomes overcharged with humus and nitrogenous matter. If the land is heavy and not very well drained, the position may then become serious. A heavy attack of collembola mites and millepedes feeding on the roots are the least of the troubles which threaten the crop. Unless the land is very light or deficient in humus a heavy dressing of organic manures once in three years should be sufficient. This should be supplemented by phosphates, and artificial fertilizers used during the intervening period.

Immediately after the heavy dressing cabbage, cauliflower, leeks, and green crops generally may be grown, followed later by deep-rooting crops such as carrots and parsnips, and these again by shallow-rooted crops such as potatoes, onions, tomatoes, and salads. By observing some such rotation the resources of the land are exploited most economically, and disease starved out by the crops which follow being generally resistant to the troubles which affected those which preceded them.

In the middle and northern districts of the Dominion hardy vegetation will commence to make new growth during the coming month, and on land that is well drained a start may be made with the new season's planting operations. Plants of lettuce, onions, cabbage, and cauliflower held in winter beds may be set out, and pickling shallots, garlic, rhubarb, asparagus, and early potatoes planted. Sowings may be made of asparagus for planting out next spring (to be started early so that good big plants may be obtained), early peas, broad beans, early turnips, cabbage, cauliflower, spinach, and salads; also onions in the drier districts where spring sowing is practised.

Mushroom-culture.

Numbers of inquiries are being received regarding the cultivation of mushrooms, and they are evidently becoming a popular vegetable. Those who purpose to grow the plant should remember it is a saprophytic fungus requiring humid conditions in a temperature of 50° to 65° F. Under natural conditions these exist during the autumn months, and an old pasture completes the necessary requirements. Such a pasture may be planted with small pieces of the plant—known as mushroom spawn—and a crop may be gathered without much trouble. In that case the method would be to remove a piece of turf about 1 ft. square, also 4 in. to 5 in. of soil from below it. In the hole place a quantity of moist fermenting stable manure that has been specially prepared, and in the centre of this a piece of spawn about the size of a small hen-egg. Firm it well with the foot and replace the turf, beating it down as firm as possible. This may be done any time during the summer, but the material should not be allowed to dry out.

Under artificial conditions the fungus may be grown at any season of the year where the necessary conditions are provided. Sheds and old mines are often mentioned in literature on this subject, as it is under such conditions that the necessary temperature and humidity may easily be obtained at all times, and the absence of light is no detriment to this plant, which obtains its nourishment from decaying vegetation. In the open, low temperatures have to be avoided, and under glass high ones would be just as detrimental; but where ample ventilation is provided cucumber-houses could be used for the purpose, and in some cases a crop might be grown on the ground beneath the plant-stage of a glasshouse.

Experiments have been carried out with other materials, but so far nothing has been found equal to strawy stable manure as a medium for growing this crop. The material must be brought to a state that is moist and evenly fermenting throughout, as in the making of a hotbed. It may then be made up into beds of a convenient width and any length, and packed firmly to a depth of about 12 in. When the heat has subsided to a temperature of 70° F. the material should be spawned—that is, planted. When the plants have commenced to run and a mould-like growth has developed (about seven to fourteen days after planting) the bed should be covered with an inch or two of fine light soil that has been passed through a sieve, and made firm with the back of a spade. This soil should be kept moist by watering from a can with a fine rose. In six weeks the beds should commence to crop, and may be expected to continue to be profitable for three to four months. The material should then be removed, and it is most valuable as a manure for the garden or compost heap. Where sheds are used the beds are sometimes made on boarded tiers about 3 ft. one above the other.

The greatest cleanliness is necessary for growing the crop successfully, as this parasitic plant may easily become a victim of other parasites and great loss be incurred through disease. Adequate ventilation is also necessary, and it must be carefully regulated to avoid temperatures that are either too low or high.

—W. C. Hyde, Horticulturist, Wellington

Importation of Fertilizers in 1929–30 : Correction.—With reference to the statistics published in last month's *Journal*, the Customs Department advises that owing to an error in description in the import entry an amount of 700 tons of Egyptian phosphate, valued at £2,391, imported at Invercargill, was stated as "phosphate not otherwise specified," from the United Kingdom. The relevant figures in Tables 1, 2, and 3 on pages 339–40 of the *Journal* should be amended accordingly, the total importation of Egyptian phosphate becoming 1,000 tons, value £3,415.

REVIEW.

Fungous Diseases of Plants, Jakob Eriksson (2nd edition, English translation by W. Goodwin); vi + 526 pp., 399 illustrations. Bailliere, Tindall, and Cox, London, 1930. £1 15s. net.

THIS book covers the major bacterial and fungous diseases of agriculture, horticulture, and forestry. Diseases are grouped according to the family or order to which the causal organism belongs, and under each is given brief notes on the symptoms, life-history, and remedial treatment. Symptoms of many diseases are illustrated by half-tones or line drawings, and fructifications of many of the pathogens are shown by line drawings.

As a general text-book purporting to cover modern knowledge of plant-diseases this work is most disappointing. The arrangement of diseases under groups of pathogens makes the book difficult to handle (the host index in the appendix being of little aid); the text is often archaic, and appears to have undergone little alteration since the first edition was published in 1912, for one gains the impression that the author has disregarded most recent literature. An annoying feature is the frequent reference in the text to authors not cited in the bibliographies following each disease.

The author persists in his mycoplasm theory, and extends it from the rusts to cover late blight of potatoes (*Phytophthora infestans*) and downy mildew of spinach (*Peronospora Spinaciae*), and, unconsciously perhaps, permits it to permeate the whole work; and this despite the constant criticisms to which the theory has been subjected from the time of its promulgation (1897), and failure of any one else to obtain evidence in its support. He still adheres to his earlier views concerning species in the rust fungi, as in the book one finds reference to *Puccinia Phleipratensis*, *P. bromina*, *P. Symphyti-bromorum*, *P. holcina*, *P. Triseti*, *P. coronifera*, *P. Poae-alpinae*, &c. Some of these are merely biologic forms of the common cereal rusts, and others are recognized only by the author.

That the author's taxonomy requires revision is indicated by the use of names now obsolete, such as *Ustilago nuda*, *Puccinia simplex*, *Uromyces caryophyllinus*, *Phragmidium subcorticium*, *Polyporus* (for *Fomes*), *Phoma oleracea*, *P. Napo-brassicae*, *Sporodesmium Solani*, *Rhizoctonia violacea*, *Mycosphaerella pinodes*, &c.

In the sections dealing with control are many recommendations that are quite impracticable, others erroneous, and others again apparently suggested because of the author's persistence in his mycoplasm theory. Thus Uspulun or Germisan is recommended as a substitute for hot water in the control of loose-smut of wheat and barley; barberry eradication is considered to be of doubtful value; removal of grasses in the vicinity of cereal crops is recommended in the control of cereal rusts; avoidance of seed from infected crops appears to be a favourite recommendation; while for the control of leaf-curl of peach-trees painting the trunks with a mixture of clay, dung, lime, and carbolineum is advised. One can picture, too, the conscientious farmer following instructions for the control of *Sclerotinia sclerotiorum*, down on his knees in a 10-acre field of Jerusalem artichokes carefully picking up by hand all sclerotia!

G. H. C.

Noxious Weeds.—Two plants have been added to the Second Schedule of the Noxious Weeds Act—which comprises noxious weeds when so declared by a local authority—namely, stinking mayweed (*Anthemis cotula*) and convolvulus (*Convolvulus arvensis* and *C. sepium*, both species).

WEATHER RECORDS: MAY, 1930.

Dominion Meteorological Office.

General Notes.

The relatively dry weather which had ruled since the beginning of February continued into May until the middle of the month. The first half of the month, owing to a persistence of anticyclonic pressure, was remarkably fine over the whole of the Dominion, with clear mild days and cool nights.

Low-pressure waves crossed southern New Zealand during the nights of the 13th and 14th, but as they were of slight intensity the rainfall accompanying them was confined to the western districts of the South Island. On the night of the 15th, however, a secondary depression of cyclonic form developed west of New Zealand, and on the morning of the 16th was centred west of Farewell Spit. Fairly general rain set in at this time with heavy falls in places, particularly from Nelson and Marlborough northwards. By the morning of the 18th this cyclone had passed away eastwards, and, since at this time an extensive anticyclone covered the whole of Australia and the Tasman Sea, indications appeared favourable for the development of another lengthy spell of fine weather. From the 18th onward, however, until the close of the month there was a remarkable frequency of depressions of the westerly type, which moved along the southern edge of the anticyclone. As a consequence strong and squally winds between west and south-west prevailed during this period, and there were many rapid and severe weather-changes. On the 20th, 21st, 26th, 27th, and 29th, there were sharp southerly changes, and thunder and hail occurred at places, while snow fell frequently on the highlands and in the South Island on parts of the lowlands.

Although considerable rain fell after the middle of the month, the total for the whole month was everywhere below the average, except in the south-west corner of the Dominion, where a slight excess occurred.

The cold of the latter part of the month and the frosty nights during the first half had an adverse effect on pastures. Consequently, though stock remained on the whole in good condition, supplementary feeding had to be resorted to in some districts. The rain, too, came too late to cause any appreciable response in growth of vegetation, so that the outlook for winter feed from pastures is far from encouraging, more particularly in the eastern districts. On the other hand, it permitted the carrying-out of agricultural work which had been seriously retarded by the prolonged dryness of the soil.

Rainfall for May, 1930, at Representative Stations.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	1·17	8	0·26	5·06
2	Russell	0·95	10	0·54	5·92
3	Whangarei	1·65	16	0·44	7·84
4	Auckland	2·74	17	0·99	4·50
5	Hamilton	2·63	12	0·73	4·54
5A	Rotorua	..	..	..	5·72
6	Kawhia	3·24	12	0·51	5·57
7	New Plymouth	4·63	13	2·67	6·23
8	Riversdale, Inglewood ..	5·91	14	3·02	9·82
9	Whangamomona	3·27	8	1·23	7·05
10	Eltham	3·70	9	0·67	5·27

RAINFALL FOR MAY—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
	North Island—continued.	Inches.		Inches.	Inches.
11	Tairua	1·40	12	0·34	7·64
12	Tauranga	2·11	8	1·50	5·16
13	Maraehako Station, Opotiki	0·60	5	0·40	5·70
14	Gisborne	1·10	5	0·86	5·67
15	Taupo	1·49	7	0·63	4·09
16	Napier	0·77	7	0·48	3·74
17	Hastings	0·57	5	0·20	3·33
18	Taihape	1·84	12	0·51	3·84
19	Masterton	1·71	14	0·34	4·03
20	Patea	2·56	10	0·68	4·34
21	Wanganui	1·50	9	0·36	3·42
22	Foxton	1·35	9	0·32	2·78
23	Wellington (Karori Reservoir)	2·68	9	0·89	4·40
	South Island.				
24	Westport	4·66	14	0·88	8·35
25	Greymouth	6·39	14	1·35	8·01
26	Hokitika	7·00	13	2·36	9·71
27	Ross	8·57	12	1·79	9·73
28	Arthur's Pass	5·53	8	1·61	11·02
29	Okuru	11·40	15	3·70	11·60
30	Collingwood	..	..	..	10·18
31	Nelson	2·53	7	0·95	3·08
32	Spring Creek	2·21	5	1·95	3·19
33	Tophouse	3·88	10	1·42	5·94
34	Hanmer Springs	1·79	9	0·70	4·51
35	Highfield, Waiau ..	..	..	..	3·41
36	Gore Bay	2·24	13	0·57	3·83
37	Christchurch	2·04	11	0·67	2·65
38	Timaru	1·20	9	0·44	1·41
39	Lambrook Station, Fairlie	1·12	3	0·60	1·53
40	Benmore Station, Clearburn	1·41	8	0·61	1·97
41	Oamaru	0·86	9	0·42	1·61
42	Queenstown	2·77	10	1·16	2·63
43	Clyde	1·10	5	0·58	0·97
44	Dunedin	1·79	14	0·38	3·23
45	Wendon	2·01	11	0·40	2·23
46	Gore	2·52	18	0·64	2·71
47	Invercargill	5·00	25	0·60	4·46
48	Puysegur Point	6·88	27	1·05	6·81
49	Half-moon Bay	5·50	21	0·89	4·50

—Edward Kidson, Director of Meteorological Services, Wellington, 6th June, 1930.

BOOKS RECEIVED.

THE CROP-GROWER'S COMPANION, by John Porter, B.Sc., N.D.A., N.D.D., Head of the Agricultural Education Department and Lecturer in Agriculture, Bucks County Council. Gurney and Jackson, London; Oliver and Boyd, Edinburgh, 1929. Price, 8s. 6d. net.

THE SOYA BEAN AND THE NEW SOYA FLOUR, by C. J. Ferrée (revised translation from the Dutch by C. J. Ferrée and J. T. Tussaud). William Heinemann (Medical Books), Ltd., London, 1929. Price, 6s. net.

THE REGISTER OF VETERINARY SURGEONS, 1930. Royal College of Veterinary Surgeons, London. Price, 5s.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

ABORTED COWS AND SPAYING.

"SUBSCRIBER," Whangarei :—

I should be pleased to have your advice concerning the following : I have had three cows affected with abortion, one having slipped twice in succession, and have decided to have them spayed. Would it be advisable to wait until all traces of discharge have vanished before having this operation performed ? Also, how soon after spaying could the cows be put with the remainder of the herd (as they are in milk) without fear of infecting the others ?

The Live-stock Division :—

It certainly would be advisable to have the cows free from all discharge before having them spayed, as there might be a chance of infection after the operation and septic peritonitis being set up. As this is not very likely, however, we consider that the operation might be performed any time after six weeks. Referring to your second question, if any cow that has aborted is isolated from the milking-herd for two or three months, then you may be fairly certain that she is not a channel of infection.

KOHLRABI FOR STOCK-FEEDING.

Inquirer," Otautau :—

Please give me some particulars of the feeding qualities of kohlrabi. How does it compare with rape for lamb-feed and swedes for cattle-feed ? How is it sown—in ridges or on the flat—and what quantity of seed per acre is used ?

The Fields Division :—

Kohlrabi is the equal of good swede for feeding and fattening purposes, but the leaves cannot be considered quite as good as rape. Usually it is grown for the bulb, which matures in much the same way as the swede, hence the leaves would not be mature or quick-growing enough to take the place of rape. A good crop of kohlrabi will yield almost as much as swedes. In good swede land a yield of 30 to 40 tons per acre can be expected. Sowing should be done in 26-in. ridges, as for swedes, using preferably 2 lb. of seed per acre. The plots can then be thinned and hoed in the same way as for swedes. Manuring is the same as for swedes in different localities. Kohlrabi usually contains a little less water than swedes, the average being about 88 per cent. ; the dry-matter content is therefore comparatively high. This plant is often called the turnip-rooted cabbage, and in Continental countries is often transplanted in the same was as cattle-cabbage. Its outstanding feature is its drought-resisting qualities. In districts where autumn droughts are common kohlrabi will often produce a heavier crop than swedes. It withstands hard frosts well, and is considered by some farmers and growers to be superior to swedes in this respect.

CRACKING OF PEARS.

"SUBSCRIBER," Huinga :—

I have a couple of pear-trees which bear fairly well, but a big proportion of the fruit cracks, more especially the fruit on the lower branches. Could you inform me of the reason and what steps should be taken to prevent the cracking.

The Horticulture Division :—

The usual cause for pear-fruit cracking is a fungous disease commonly known as black-spot. Some varieties are very susceptible to the trouble and difficult

to keep clean in certain localities. The best preventive is a bordeaux spray made and applied in the manner described in the Department's Bulletin No. 77, "The Home Orchard," a copy of which has been forwarded to you.

THE TREE STINGING-NETTLE AND FARM-ANIMALS.

G. H. MONRO, Havelock :—

Can you inform me whether any instances are known of calves dying as a result of contact with the tree stinging-nettle? I have known of cases of dogs becoming extremely ill from this cause, and one case of a slut, suckling pups, which died from being stung by the nettle.

The Live-stock Division :—

No cases of deaths among calves from nettle-sting are on record. Dogs are more sensitive to the effect of the acid from the nettle. It is improbable that even severe stinging by the tree-nettle would cause deaths in calves, on account of their less sensitive skins. Severe lesions of urticaria may be set up, especially in the vicinity of the natural openings of the body. In this connection very considerable swellings may be noticed round the eyes and muzzle. Depending on the amount of nettles present so will precautions be necessary to prevent a serious infection with the acid of the plant. In the case of young calves it would be advisable to fence off the nettle area if possible.

GROUND LIMESTONE AND GROUND BURNT LIME.

W. D. WILLIS, Greatford :—

Would you kindly advise me upon the relative merits of burnt lime and ground lime as a top-dressing for a property which last year received 3 cwt. basic slag, followed by 1 cwt. sulphate of ammonia. Although burnt lime is very unpleasant to handle, I am prepared to use it if worth while.

The Fields Division :—

It may be explained that both forms of lime are on the market as "ground" lime, and the term is confusing unless specified as "ground limestone" or "ground burnt lime." Their relative values as soil-improvers are virtually the same, provided consideration is given to the proportion of calcium (pure lime) that each contains. For instance, ground limestone (unburnt) contains about 54 per cent. calcium, whereas ground burnt lime contains about 100 per cent. In other words, if you decide to lime your land by applying, say, 1 ton of ground limestone per acre, you would require only approximately 11 cwt. of burnt lime per acre, to give the same amount of pure lime per acre. Other important considerations are cost of transport, convenience in handling and storing, and soil-type. Should the farm be far distant from the rail, transport of approximately double the quantity of ground limestone to burnt ground lime may be an important economic consideration. Burnt ground lime is not pleasant to handle, corrodes the ironwork of implements, and as it absorbs moisture from the atmosphere it bursts the sacks in which it is stored and is generally unpleasant. While ground limestone is more bulky to handle and in consequence more costly to transport, it has none of the unpleasant handling-qualities of burnt ground lime, and can be applied to almost any type of soil without harm, whether heavy clays or light sandy soils, and where necessary with good effect, whereas burnt ground lime should never be applied to light soils or soils short of humus. Fineness of grinding is an important factor in the efficiency of ground limestone.

Chilean Nitrate Organization. — The delegation of the Chilean Nitrate Producers' Association for Australia, New Zealand, and Pacific Islands, which was suspended a year or two ago owing to economic difficulties, has been re-established, with headquarters at Sydney as previously. Mr. Alfred E. Stephen, F.I.C., has resumed the position of delegate in charge.

WHEAT AND OATS THRESHINGS.

TABULATED below are returns of threshings of this season's wheat and oats crops received by the Census and Statistics Office up to 19th May, covering the period January–April, 1930 :—

Land District.	Wheat.					
	Firsts.			Seconds.	Total threshed.	Average Yield per Acre.
	Tuscan or Longbury.	Hunters (Varieties).	Pearl or Velvet.			
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels
Gisborne ..	480	..	..	..	480	30·00
Hawke's Bay ..	10,267	3,266	..	1,013	14,546	32·84
Wellington ..	49,626	8,128	15,998	3,157	76,909	39·10
Nelson	8,262	12,058	380	1,489	22,189	23·73
Marlborough ..	65,716	17,112	1,249	5,124	89,201	29·46
Canterbury ..	3,753,104	829,035	257,380	182,638	5,022,157	30·63
Otago	341,375	170,907	132,631	39,191	684,104	34·08
Southland ..	58,631	3,809	8,053	1,764	72,257	42·98
Totals ..	4,287,461	1,044,315	415,691	234,376	5,981,843	31·14

Land District.	Oats.					
	White.	Dun.	Black.	Algerian.	Total threshed.	Average Yield per Acre.
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Gisborne ..	..	..	..	252	252	42·00
Hawke's Bay ..	192	..	..	9,298	9,490	42·68
Wellington ..	2,553	760	404	21,318	25,035	41·73
Nelson	180	..	..	5,742	5,922	28·61
Marlborough ..	4,269	1,442	280	16,885	22,876	33·22
Canterbury ..	590,023	113,240	13,494	188,046	904,803	38·09
Otago	568,041	35,789	21,380	53,353	678,563	52·65
Southland ..	684,555	18,711	3,940	..	707,206	58·83
Totals ..	1,849,813	169,942	39,498	294,894	2,354,147	46·74

STOCK SLAUGHTERED, 1929–30.

FOLLOWING are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1930 :—

Stock.	Abattoirs	Meat-export Slaughter-houses.	Bacon-factories.	Ordinary Slaughter-houses.	Totals 1929–30.	Totals 1928–29.
Cattle ..	146,050	138,467	..	78,451	362,968	403,330
Calves ..	45,165	393,513	..	1,696	440,374	394,987
Sheep ..	580,115	2,598,510	..	241,657	3,420,282	2,980,066
Lambs ..	107,533	6,462,783	..	24,319	6,594,635	6,149,482
Swine ..	141,208	279,230	38,170	27,299	485,907	470,493

—*Live-stock Division.*